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Growth of the Automotive Industry Since 1923 Based on Foreign Trade

Says
D. M. Phelps

But no reliance can be placed upon export business as a means of overcoming the downswings of the production cycle, marketing authority is led to conclude + + + +

COMPREHENSIVE, first-magnitude studies of the economics of automobile production and distribution may almost be counted on the fingers of one hand. To the select company may now be added another,* which, although its primary thesis is concerned with a restricted field, inevitably includes a much wider compass in its certain deductions.

Within the last year the cultivation of export markets by American automotive producers has shown two distinct tendencies. The first involved a diminution of sales effort on the part of individual producers, as reflected in the wholesale repatriation of export fieldmen, and reduction of advertising, promotion, and plant expenses abroad. In one or two cases foreign assembly plants have been closed, or the operation of them transferred to local distributors. These developments have more or less reflected those in the domestic field.

On the other side of the picture there has been a continuance of, and in some cases an increase of institutional promotion for vehicle sales and highway building in foreign markets. This fact may be established by reviewing recent programs of the National Automobile Chamber of Commerce, the Overseas Automotive Club, the Automotive Division of the Commerce Department, the Bureau of Public Roads, and the Highway Education Board. This in brief is the present state of the automotive-export coffee pot, into which Mr. Phelps drops his eggshells of clarification.

The conclusions in the study are easy to get at. In fourteen brief sections they serve as preface to the factual material upon which they are based.

Much has been said recently about the possibility of automotive exports serving as a balance for the major downswings in the production cycle. Such discussion has apparently been based on scattered evidence from markets such as Argentina, which as Mr. Phelps points out, furnishes the almost perfect antithesis to the domestic market, the peak in its sales occurring at about the same period as the low point in annual domestic sales. It might be concluded from this that intensive cultivation of the Argentine and similar markets would have a favorable effect on domestic production. But again, as Mr. Phelps indicates, when the sales of a single producer in any foreign market become large enough, the tendency is to establish an assembly plant, which reduces the utilization of capital goods involved in the manufacture of the completed vehicle in the United States. "No reliance, therefore, can be placed upon export business as a means of overcoming the major downswings of the production cycle," Mr. Phelps is led to conclude.

* "Effect of the Foreign Market on the Growth and Stability of the American Automobile Industry," by D. M. Phelps, assistant professor of marketing, University of Michigan. 1931, Bureau of Business Research, University of Michigan, Ann Arbor. Vol. III, No. 5, in the "Michigan Business Studies."

Source of Supply of Motor Vehicles for World Market Outside United States and Canada

Year	United States and Canadian Exports (inter-exports out)			Outside Production less Exports to United States and Canada			Net Additions or Total Supply Outside United States and Canada			Percentage Passenger Cars from		Percentage Trucks from		Percentage Total Vehicles from	
	Pass. (1)	Trucks (2)	Total (3)	Pass. (4)	Trucks (5)	Total (6)	Pass. (7)	Trucks (8)	Total (9)	U. S. and Canada (10)	Outside (11)	U. S. and Canada (12)	Outside (13)	U. S. and Canada (14)	Outside (15)
1921	49,829	12,095	61,924	.....	.....	167,578	.....	.....	229,502	...	...	...	...	27.0	73.0
1922	127,073	22,982	150,055	.....	.....	200,480	.....	.....	350,535	...	...	...	...	42.8	57.2
1923	226,546	58,735	287,281	.....	.....	278,629	.....	.....	563,910	...	...	...	...	50.6	49.4
1924	254,754	75,616	330,370	.....	.....	356,842	.....	.....	687,212	...	...	...	...	48.1	51.9
1925	358,028	119,476	477,504	.....	.....	466,229	.....	.....	943,733	...	...	...	...	50.6	49.4
1926	315,193	115,121	430,314	.....	.....	530,166	.....	.....	960,480	...	...	...	...	44.9	55.1
1927	330,063	146,040	476,103	427,947	155,980	583,927	758,010	302,020	1,060,030	43.5	56.5	48.4	51.6	44.8	55.2
1928	425,093	178,956	604,049	458,741	142,225	600,966	883,834	321,181	1,205,015	48.1	51.9	55.7	44.3	50.1	49.9
1929	465,104	312,382	777,486	522,456	148,398	670,854	987,560	460,780	1,448,340	47.1	52.9	67.8	32.2	53.7	46.3
1930	251,524	169,004	420,528	461,587	139,946	598,533	713,583	305,950	1,019,061	35.3	54.7	55.2	44.8	41.3	58.7

It is fairly well understood that "the greater part of what expansion the industry has experienced since 1923 can be traced to export demand."

During the comparatively brief period named this demand reached a point where it is safe to conclude that "no other of our major manufactured products has secured such a dominant position in foreign countries."

For a time, the momentum given to the industry by this condition has been of extreme value. But in this terrific expansion are found the germs of other conditions not so favorable to continued, healthy growth of export markets:

"The last decade has witnessed an actual increase in the size, power capacity, and price of American cars, and as a result they have become progressively less suited to the requirements of the European market. Then the annual change in the product, the American policy of bringing out new yearly models, needlessly complicates the entire foreign market situation. It appears that if American manufacturers are to realize upon the potentialties of the European market by making available a product which meets European requirements, they must produce such a product within Europe through subsidiary organizations."

Looking at the picture broadly, from the standpoint of the stabilized utilization of domestic production facilities, there are some favorable points in the long-term view.

"The rate of increase in registrations and also the extent to which the United States and Canada will be the supply source of additional registrations will vary between different parts of the export market. Because of the development of the European industry both by American and native concerns, the European market will be one of decreasing relative importance for the American exporter. Australia and New Zealand likewise appear to be markets of decreasing relative importance because of (1) general economic conditions, (2) the present extent of automotive development, (3) the preferential tariff arrangements which favor the products of Great Britain, and (4) the growth in native output of parts and equipment. In time American firms are likely to supply the Oceanic market from their English rather than from their American plants. South America, Central America, Asia, and Africa should be increasingly good markets for American automotive products after the present unsettled economic conditions become more stable. Well developed distributive organizations in these countries and an absence of preferential treatment to competitors should enable American firms to hold their dominant competitive position."

An enlightened tariff policy in the United States, one which would be more in keeping with our status as a creditor nation would do more than any single thing to aid our foreign trade, Mr. Phelps writes. Some of his reasons for reaching this position follow:

"While the direct effect of the tariff barriers of some European countries has been to retard American exports, the indirect influence which they have exerted through causing higher prices has probably been of even greater significance. American exporters have not as yet been excluded from foreign markets by governmental tariff action. They have been able to compete successfully with the home industries of most countries notwithstanding this additional handicap. It follows, therefore, that the full amount of the customs duties and of the internal taxes based upon them do appear in retail sales prices. Under conditions of free trade, these prices could be decreased from 15 to 30 per cent, depending upon the level of the import duty, and still allow producers and distributors their usual profit margins. The effect of any such reduction in

Relation Between United States Exports of Automotive Products (Excluding Tires) and the Total of Semi-Manufactured and Finished Products (1911-1930)

Year	Semi-Manufactured	Finished Products	Total (Col. 1 + Col. 2)	Automotive Products	Automotive Exports $\left(\frac{\text{col. 4}}{\text{col. 3}}\right)$
	Thousands (1)	Thousands (2)	Thousands (3)	Thousands (4)	Per Cent of Total (5)
1911	$309,152	$598,368	$907,520	$19,178	2.11%
1912	348,150	672,268	1,020,418	28,308	2.77
1913	408,807	776,297	1,185,104	33,301	2.81
1914	374,224	724,908	1,099,132	34,172	3.11
1915	355,862	807,466	1,163,328	74,370	6.39
1915*	268,002	798,546	1,066,548	37,185	3.49
1916	912,262	2,625,364	3,537,626	120,685	3.41
1917	1,315,242	2,705,845	4,021,087	120,253	2.99
1918	1,053,270	2,069,242	3,122,512	96,700	3.10
1919	922,246	2,563,505	3,485,751	151,688	4.35
1920	958,497	3,204,858	4,163,355	298,230	7.16
1921	410,167	1,626,849	2,037,016	81,928	4.02
1922	437,730	1,292,307	1,730,037	103,201	5.97
1923	563,718	1,477,759	2,041,477	170,612	8.36
1924	610,668	1,588,052	2,198,720	209,871	9.55
1925	661,683	1,843,334	2,505,017	318,386	12.71
1926	655,547	1,956,781	2,612,328	320,179	12.26
1927	699,727	1,981,955	2,681,682	388,528	14.49
1928	716,352	2,260,002	2,976,354	500,177	16.81
1929	729,013	2,531,823	3,260,836	539,300	16.54
1930	512,864	1,898,777	2,411,641	277,427	11.50

*Six Months.

price upon the volume of our export business is indeed difficult to predict, but that there would be an increased demand is hardly questionable. Experience in the United States has amply proved that the demand for automotive vehicles is flexible, that an increased demand for cars results from a decreased price. Any immediate reduction in tariff rates is hardly conceivable, for the present movement is in the opposite direction. Yet an enlightened tariff policy in this country, one which would take into account our recently acquired creditor status among the nations, would do more to aid our foreign trade than any other single factor.

"Partly as a result of the numerous protective efforts made by various governments, the growth in European automobile production has been both consistent and rapid, and thus constitutes a definite restrictive force to our continued export growth. European manufacturers not only are supplying to a greater and greater extent the needs of the countries in which they are located but are also attempting to gain a foothold in other markets. Although the rate of increase in production has not been so rapid as was our own in the earlier years of the industry, still European output increased threefold in the period from 1922 to 1928, and since 1925 the average rate of growth has been about 10 per cent each year.

"In 1930, European producers made a notable gain, for they supplied 58.7 per cent of outside world demand in comparison to 46.3 per cent in 1929. Conversely, the supply originating in the United States and Canada dropped from 53.7 per cent in 1929 to 41.3 per cent in 1930. Partial explanation of this change is found in price tendencies. Evidently in periods of world-wide depression demand for motor vehicles is more severely curtailed in non-industrial countries, those in which chief reliance is placed on the export of raw materials and agricultural products. Such products decline in price more rapidly and reach lower price levels than do manufactured commodities and, therefore, purchasing power is lessened to a greater extent. As European manufacturers were supplying the larger part of the automotive demand of their own countries—a demand which decreased in the aggregate only 7 per cent in 1930, as compared to 1929—their gain in 1930 as the supply source of total outside world demand is understandable. And let us note that the same condition was present in 1921. In that year only 27 per cent of outside world demand was supplied from American imports whereas 73 per cent came from European plants. By 1923, however, American manufacturers were again supplying over 50 per cent and continued to improve their position slowly until 1930. It appears probable that with the return of more favorable world economic conditions American exporters will regain at least part of the ground lost in 1930."

Percentage of Automobile Production Exported (1918-1930)

Year	United States			Canadian			Total (Inter-exports eliminated)		
	Passenger	Commercial	Total	Passenger	Commercial	Total	Passenger	Commercial	Total
	%	%	%	%	%	%	%	%	%
1918	3.9	4.5	4.0	9.3	27.8	11.0	3.5	4.6	3.7
1919	4.1	5.6	4.3	24.5	42.4	26.1	4.5	6.0	4.7
1920	7.5	9.1	7.7	21.5	48.6	24.4	7.6	9.6	7.9
1921	3.2	8.2	3.6	15.2	27.6	16.2	3.3	8.1	3.7
1922	4.4	9.0	4.9	38.1	31.4	37.6	5.3	9.2	5.7
1923	4.9	12.4	5.6	44.9	64.7	47.5	6.0	14.5	6.8
1924	6.9	16.4	7.9	38.3	70.8	42.7	7.7	18.4	8.8
1925	8.3	21.2	9.8	42.8	61.3	45.8	9.2	22.8	10.8
1926	7.5	20.2	8.9	32.1	54.7	36.3	7.9	22.2	9.6
1927	11.1	8.6	13.4	27.3	53.7	32.1	10.7	29.4	13.3
1928	10.8	29.9	13.2	28.2	53.5	32.8	10.6	30.5	13.1
1929	9.6	36.5	13.5	31.9	62.1	38.7	9.7	37.6	13.8
1930	8.7	27.5	11.9	23.8	49.0	29.0	8.7	28.0	12.0

After reviewing the principal influences acting upon the growth and structure of the export market, Mr. Phelps, at the end of his study, analyzes the "Possibilities of Export Growth by Continents." Soundly documented, like the rest of the study, this section furnishes a valuable and comprehensive background for future export action within the industry. Space does not permit other than brief quotation, but some of the salient points follow.

Oceania. "Any extensive increase in the volume of our automotive exports to Australia and New Zealand seems improbable under existing circumstances, even in view of the rapid increase in registration. Since 1924 registrations have nearly trebled. Each year about one hundred thousand cars have been added to the total. It will be noted that the percentage of outside registrations which are found in Oceania has not increased as it has in some other continents. As a result of the rapid increase in registrations, Australia now has one car to every 11 people and New Zealand one car to every seven people. Nowhere else, outside the United States and Canada, are cars used so extensively. The chief reasons for this undoubtedly has been the high level of purchasing power. Per capita wealth is estimated to be almost equal to that in this country, and wealth is well diffused among the population. Another favorable factor has been the rate of taxation on motor vehicles. In Australia, automobile taxes approximate those in this country, in New Zealand they are even lower. But conditions now are much less favorable than they were a few years ago, for the level of purchasing power has decreased markedly."

Africa. "Although the aggregate importance of our automotive exports to Africa is less than to any other continent, and in all probability will continue to be so, nevertheless the situation is favorable to an increased use of motor vehicles. Registrations have increased both steadily and rapidly since 1924, and Africa's pro-

(Turn to page 764, please)

The new "hired man" has come!

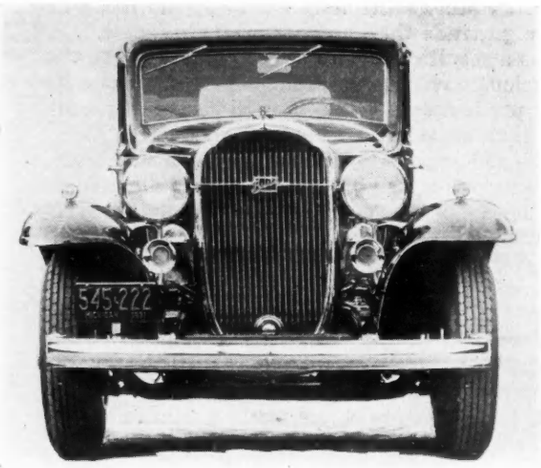
These have been dramatic years for the farmer—his hired man left him, so he bought an automotive helper.

How cars and trucks have put the farmer on America's great "main street"—a network of paved highways extending from Florida's orange groves to the bountiful apple ranches of Oregon and from the wheat fields of the Red River to the gardener's paradise of Louisiana, will be told next week by Norman Damon in Automotive Industries.

A member of the National Automobile Chamber of Commerce staff in Washington, Mr. Damon has studied this great "farm relief" program, which opens up one of the world's most important automotive markets.

1932 Buick Line Has Automatic Clutch

by Athel F. Denham



Front view of the new Buicks showing the new radiator outline, new windshield structure and twin horns + + + +

WHAT is undoubtedly the point of chief interest in the Buick line for 1932 is the addition of vacuum control for the clutch. This control can be either rendered completely automatic or else cut out altogether by merely placing the left foot on a button on the toeboard, or removing it therefrom.

This automatic clutch, which is supplied to Buick by the Bendix Aviation Corp., differs from the design offered for service installation work. While the ability to free wheel is one of the features of this automatic clutch—this being the first General Motors car offered with this feature—it is regarded as more or less incidental, the chief object in providing automatic clutch control being simplification of the gearshift operation, welcome, no doubt, to women drivers.

There are five control valves in the Buick automatic clutch. Two of these are really "switches" which start engagement and disengagement, while three others control the "rate" of engagement. These various valves are connected as follows:

1. The primary control valve—connected to the control button to the left of the clutch. When this is closed, that is when the button is not depressed, the automatic feature does not operate.

2. The secondary control valve—connected to the accelerator pedal in such a manner that when the foot is removed from the accelerator, the valve opens the line from the intake manifold—resulting in clutch disengagement. When the accelerator is again depressed the vacuum is shut off and air enters the line, permitting reengagement of the clutch.

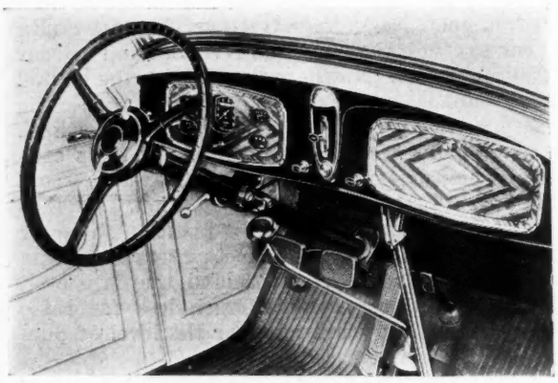
3. The three rate-of-engagement-selecting valves are located at the transmission. These valves are selected automatically by the position of the gearshift lever. That is, there is one valve for low and reverse, one for second speed, and one for high.

The first two controls mentioned cannot function independently. If the second is to work, the primary valve must be open. The three selector valves are in the form of different sizes of orifices which restrict the flow of air into the vacuum cylinder by a definite amount, according to the softness of engagement desired. The softest engagement (or slowest air-flow) is provided for low and reverse, a somewhat faster engagement for second speed, and the fastest for high.

Aside from the use of these valves, the Buick automatic clutch mechanism is distinguished by the use of a diaphragm instead of a piston in the vacuum chamber. Moreover, the automatic operating mechanism is hooked up directly to the clutch throwout, instead of to the pedal, so that there is no movement of the clutch pedal when the automatic feature operates.

When driving in a straight course, if the foot is removed from the accelerator pedal, the clutch will disengage and the car will free-wheel as long as the left foot remains on the control button. To get out of free wheeling it is only necessary to remove the foot from the button, whereupon the clutch reengages, regardless of the position of the accelerator pedal.

The chief reasons for retaining the clutch pedal seem to be (1) that the use of the pedal in the normal manner makes parking easier and (2) that in case of



Instruments in the Buicks are located in one panel at the left, visible through the steering wheel. The panel at the right is a door to a large glove and map compartment. Note the location of the "Wizard" control button near the clutch pedal + + +

Control and Adjustable Ride Regulator

failure of any part of the automatic operating mechanism, the car can be operated in the conventional manner through the use of the pedal.

A number of important amidships improvements have been made coincident with the adoption of this clutch. Helical constant-mesh gears are now used in the synchromesh transmission for quieter operation in second speed. A clutch facing of better quality with a higher coefficient of friction is used to decrease wear, and maintain consistent operating smoothness. A larger New Departure ball bearing is used for the clutch release bearing, to take care of any additional loads due to free wheeling, and the clutch pilot bearing also is larger. Spline shafts of the transmission and synchronizer parts are now ground to closer tolerances, synchronizing clutches have been increased in size for quicker action, and roller bearings adopted for the countershaft.

Perhaps next in interest to the clutch control is the ride regulator, a manually adjustable set of shock absorbers. Instead of having a fixed orifice for the oil in the Delco Products hydraulic shock absorbers, a needle valve is used. This needle valve can be raised or lowered to restrict or open up the orifice by means of a lever located on the steering column, and a linkage which closely resembles a four-wheel brake hookup, with equalizers, etc. The "ride regulator" permits the selection at will of anything from a soft "boulevard" type of ride to a very firm ride for high speeds. The ride regulator is standard equipment on all except the two lowest priced body models on the 114-in. wheelbase line (the business coupe and the five-passenger sedan).

In the general appearance of the cars there are three outstanding changes—the new radiator outline, the

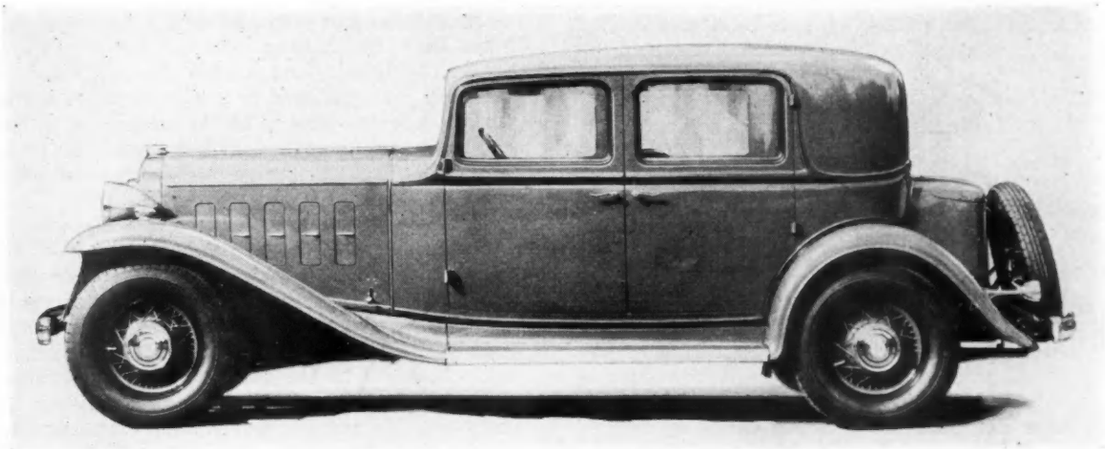
Buick is the first General Motors car to offer free wheeling effect of the new automatic clutch +

"aerodynamic" windshield and hood doors replacing louvers. The decidedly greater slope of the windshield reduces the head resistance, as does the elimination of the exterior visor. While the windshield still can be raised by the usual crank, ventilation is now through a large top cowl ventilator in addition to the side cowl ventilators.

The new radiator outline is clearly shown by the photograph. A new touch is provided by the use of chrome beads on the radiator shutters. Bumpers are new in design, and the license bracket has been moved to one side, so as not to obstruct the radiator.

All coupe models now have windows to the rear of the doors, metal decks and French type roofs. Several body models have been added to the line, including a 5-passenger Victoria coupe on the 114 and 118 in. chassis, a club sedan, three convertible phaetons on the 118-in. chassis, and a convertible coupe and a special sedan on the 114-in. chassis. There is also a club sedan on the Series 90 chassis, the wheelbase of which has been increased 2 in. A similar increase in wheelbase has been made on the Series 90, this now being 134 in.

For heat and noise insulation the top inside section of the cowl is now also lined with fibrous material.



The club sedan on the Series 80 and 90 chassis is one of the most attractive body models in the line. Note the large trunk, which is standard equipment + + + +

1932 Buick Prices

BODY MODEL	Series 50 1932	Series 50 1931	Series 50 Down	Series 60 1932	Series 60 1931	Series 60 Down	Series 80 1932	Series 80 1931	Series 80 Up	Series 90 1932	Series 90 1931	Series 90 Up
2-p. Bus Coupe	$935	$1025	$90	$1250	$1285	$35	none	....	no	none	none	no
5-p. Sedan	995	1095	100	1310	1355	45	$1570	$1565	$5	$1805	$1785	$20
4-p. Spec. Coupe	1040	1055	15	1270	1325	55	none	1535	no	none	1720	....
5-p. Vict. Coupe	1060	none	new	1290	none	new	1540	none	new	1785	1765	20
5-p. Spec. Sedan	1080	1095	15	none	none	...	none	none	....	none	none	no
4-p. Conv. Coupe Roadster	1080	1095	15	1310	1335	25	none	none	....	1805	1785	20
5-p. Conv. Phaet.	1080	none	new	1310	none	new	none	none	....	1830	none	new
5-p. Spt. Phaeton	1155	1055	up 100	1390	1335	up 55	none	none	....	none	none	no
7-p. Spt. Phaeton	none	none	....	none	none	....	none	none	no	1675	1620	55
4-p. Ctry. Club Coupe	none	none	....	none	none	....	none	none	no	1740	1720	20
5-p. Club Sedan	none	none	....	none	none	....	none	none	no	1820	none	new
7-p. Sedan	none	none	....	none	none	....	none	none	no	1955	1935	20
7-p. Limousine	none	none	....	none	none	....	none	none	no	2055	2035	20

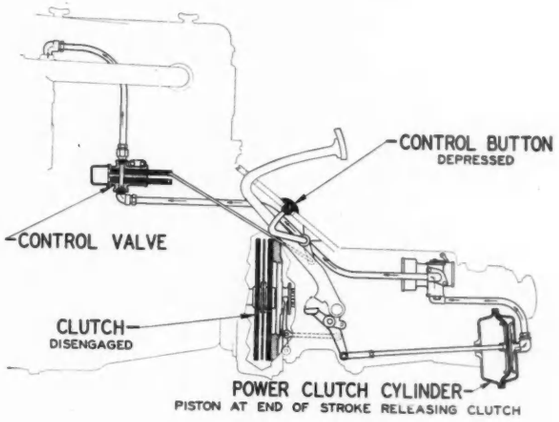
The 2-p. Bus. Coupe and the 5-p. Sedan on the Series 50 do not carry ride control, demountable wheels, dual tail lamps, etc. They are price leaders for advertising purposes. In the table above, the corresponding 1931 model is shown therefor both as compared with the standard and the special sedan and coupe. The latter might really be called the "standard" model.

Door and body panels are coated with insulating material and openings around controls are closed by heavy felt.

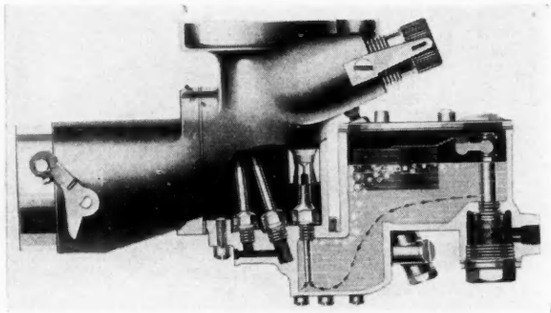
All body panels are now welded together, except the rocker panels between front and rear doors, which are left open to provide flexibility. All moldings are stamped directly into the body panels. An especially neat job has been done with the molding treatment near the windshield. Fenders and hood sills are now in one piece, and rounded off to eliminate the former angular shape, improving the appearance. The cover plates in the running board skirts have been eliminated by relocation of the chassis lubricating fittings. Door hinges are fitted with bronze bushings. Door dovetails have been changed so as to provide greater ease of door opening.

Attention should be called to specific changes applying to the series 50, the lowest-priced line, which has been brought further into line with the other Buick models. The refinements include roomier bodies, an increase of 1/16 in. in bore, and the adoption of dual carburetion for increased horsepower and better performance. The breather has been moved to the center of the crankcase to reduce noise; axle shafts and tubes have been increased in diameter to the same size as in the Series 60; and the final ratio has been changed from 4.54 to 4.6 to 1, for improved acceleration. This model now carries the same type of brake as other Buick models. Other parts that have been increased in size are the front axle spindles, steering wheels and the steering column.

Returning to the engines, two thicknesses of cylinder gaskets are now furnished to give either a high or a low compression ratio. The thinner gasket is claimed to increase the output of the engine by 3 hp. "Cooler" spark-plugs are supplied with the higher compression ratio. The springs in the harmonic balancer in the Series 80 and 90 are now slotted to improve lubrication and reduce noise during cold weather starting.



Diagrammatic layout of the Buick vacuum operated clutch throwout mechanism. At the left are the two control valves, the foot button controlled primary above, and the automatically operated secondary below. The selector valves for varying engagement rates for different transmission speeds is shown to the left and above the diaphragm type vacuum cylinder. See the story for additional details + + + + +



Changes have also been made in the carburetor to avoid chances of vapor lock, as by extension of the nozzles well down into the float chamber + + + + +

In the lubricating system the oil inter-cooler now has the core enclosed in a casting with a pressed steel cover, and the unit is tilted somewhat to insure complete draining. The cooling capacity has been increased on all models by the adoption of thicker cores, and an increase in fan capacity.

Cold-weather starting and hot-weather vapor lock possibilities have been given serious attention in the new models. Battery capacity has been increased by from 12 to 20 per cent and the starter ratio 27 per cent. To prevent vapor lock, the fuel line from the gas tank is carried outside the frame siderail on the side opposite to the muffler, up to the cross member back of the engine. There it crosses over to the carburetor side, but is covered with heat-insulating material. The size of the fuel pump has been increased, and in the carburetor the jets extend well down into the float chamber to prevent the picking up of vapor

bubbles, which latter are permitted to pass out of the float chamber through a larger vent hole.

By placing a door in the lower front end of the hood to direct cold air from outside toward the intake, the temperature of the air entering the carburetor through the intake silencer has been lowered 40-50 deg. This door is in the form of a scoop, and can be closed in cold weather. A shield has been placed over the enlarged intake silencer below the exhaust manifold.

To prevent oil leaks the Series 50 and 60 models now also have a boot over the universal ball housing. Oil seals are also furnished on the forward end of the transmission shifter forks, at the back-up light switch and at the front end of the countershaft.

All rear axles have been stiffened. Differential carriers now have external ribs, and diameters of torque tubes on the two longer chassis have been increased from 2¾ to 3 5/32 in. at the strut rod lug. On the pressed-steel axle housings the brake flange disks are now welded instead of being riveted castings.

Bronze thrust washers are now placed back of all differential gears to prevent scoring. Pinion bearings are press fitted on to shafts, and pinion bearing spacers are keyed directly to the shaft. In the 60 Series there is also a larger pinion shaft, and a larger diameter ring gear coincident with a change in gear ratio from 4.45 to 1 for somewhat improved acceleration.

Chassis spring leaves now have their ends curled, and corners are trimmed to give a fuller bearing surface. This is intended to provide riding qualities from the start equal to those formerly produced only after considerable mileage on the spring leaves. On the Series 90 metal spring covers are furnished.

The 1932 Buicks also carry a new type of spring shackle, in which the shackle bolt, instead of being plain, is threaded into the spring end, so as to leave considerable side clearance without play. The threads assist in retaining the lubricant and provide a take-up for wear by settling into the grooves.

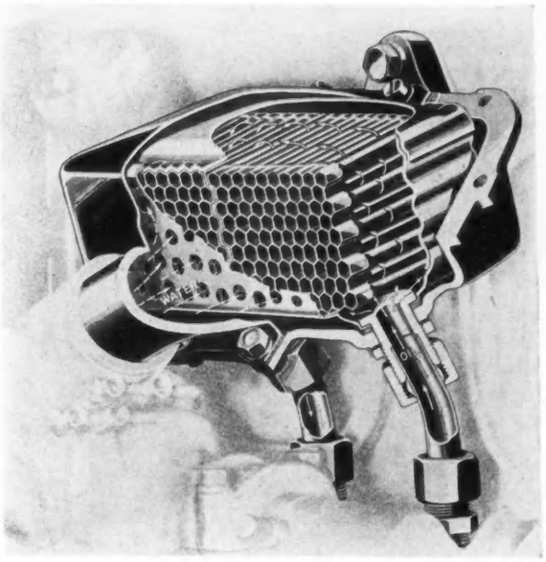
In the steering gears the throttle friction is moved to the bottom of the gear; the controls are mounted above the steering wheel hub to prevent binding, and control tubes have been both increased in diameter and provided with buffer springs to reduce chances of rattling. Brake rods are now fitted with anti-rattle springs at all connections.

Except on the two lowest priced body models of the Series 50, five wire or five wood wheels are optional standard equipment. Both types have drop center rims of 18 in. nominal diameter, and carry larger tires throughout. On the Series 50 the tire section is now 5.50; on the Series 60 it is 6.00, and on the two largest models, 7.00 in.

Windshield wipers are now operated from a vacuum booster pump built into the fuel pump by A C Spark Plug Co. It is standard equipment on the three larger models and extra on the Series 50. Double wipers are furnished on practically all except the Series 50 body models. Convertible models have the wipers mounted at the base of the windshield.

The new windshield has made possible the insertion of a deep glove or map compartment with lock on the right side of the instrument board panel, (left for export), balancing the group of instruments which are now all located in a panel immediately in front of the driver, where they can be readily seen through the three-spoke steering wheel. Universally adjustable interior sunvisors are another new feature.

Dual chrome-plated horns are mounted below each headlamp. Hood catches are of the concealed type and lock the hood to the dash and the radiator shell.



Cutaway view of the improved oil intercooler on the 1932 Buicks. Special attention has been given to ease of draining

Dash gasoline gages are now of the electric type. A chrome-finished panel in the center of the instrument board combines a direct lighting reflector, carburetor-heat control, and choke and spark buttons. An ornamental button at the bottom can be removed for the installation of a cigar lighter. Similarly the center panel on the glove-compartment door can be removed and a clock installed.

Rubber pads are furnished on the pedals. Locking type door handles are now provided. The locking door handle on the right front door snaps to the unlocked position when the door is closed, to prevent accidental locking of the cars with the keys inside.

Steering columns are made adjustable and an adjustment is also provided at the rear end of the steering drag-link so that the steering wheel may be kept in proper position to maintain an unobstructed view of the instruments. Except in the phaeton and limousines, drivers' seats have a new adjustment mechanism operated by raising a handle at the left side of the seat, whereupon the seat can be rolled either forward or back. Series 80 and 90 carry cigar lighters, except on the 96C and 96S. Ash trays are placed in all front compartments and double trays in the rear.

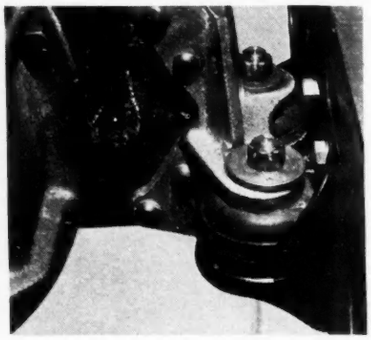
A special safety glass of high reflective qualities is used for the tail lamp to warn motorists approaching from the rear, even if the bulb should happen to be burned out. Dual tail lamps are now used on all except the Series 50, 114 in. wheelbase sedan and business coupe, on which they are extra.

Trunks are furnished as regular equipment on the Series 50 and 60 five passenger convertible phaetons, on the Series 80 five passenger victoria coupe and the Series 90 club sedan.

Mohairs and whipcords are standard upholstery materials on closed models, with genuine leather, piped in contrasting shades on the open, and whipcord optional convertibles. Seven trimming combinations are offered on the Series 90 limousine.

Closed cars have wood finished garnish moldings, those in the Series 80 and 90 cars being of genuine walnut.

Pierce-Arrow Brings Out New Eight to



A new system of mounting has been adopted for the Pierce-Arrow engine, using an unusually large amount of relatively soft rubber. This shows on the rear engine supports at the side rail. The two-unit rubber structure is to help in reducing "pitching" movements. There is also a mounting at the rear of the transmission + +

Prices Are Conspicuously Low for Pierce-Arrow

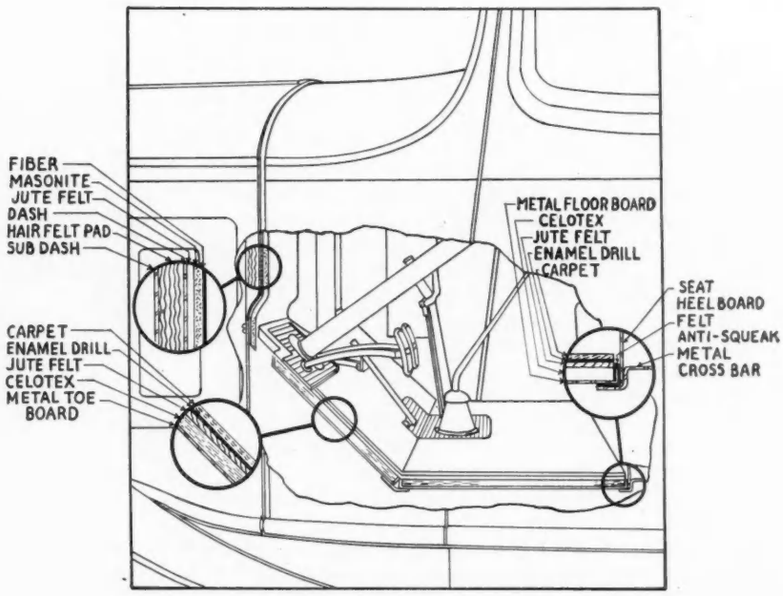
Chassis Model	Model 54	Model 53	Model 52
Wheelbase	142-137	137-142	142-147
No. of Cylinders	8	12	12
Club Brougham	$2,385	$3,185	None
5-p. Sedan	2,485	3,285	$3,785
5-p. Club Sedan	2,650	3,450	3,885
5-p. Club Berline	2,850	3,650	4,085
5-p. Convt. Sedan	2,950	3,750	None
7-p. Sedan	2,750	3,550	4,085
7-p. Encl. Dr. Limousine	2,950	3,750	4,250
4-p Coupe	2,485	3,285	None
4-p. Convt. Coupe Roadster	2,650	3,450	None
5-p. Tourer	2,750	3,550	None
5-p. Sport Phaeton	3,050	3,850	None
7-p. Tourer	2,850	3,650	None

PIERCE-ARROW MOTOR CAR CO. this week is announcing its 1932 line of eight-cylinder cars, which are being offered in two lengths of wheelbase, 137 and 142 in. Prices of these cars have been materially reduced, as will be seen from the price list printed herewith. In addition to the eight-cylinder models there will be two lines of twelve-cylinder cars, on three wheelbases ranging from 137 to 147 in. which will be announced probably at the time of the New York show.

There are a total of 12 body styles on each of the eight-cylinder and the smaller 12-cylinder chassis, the eight ranging in price from $2,385 to $3,050, the smaller twelve from $3,185 to $3,850, and the larger twelve from $3,785 to $4,250. In a still higher price range will be a line of custom built bodies on the larger twelve cylinder chassis.

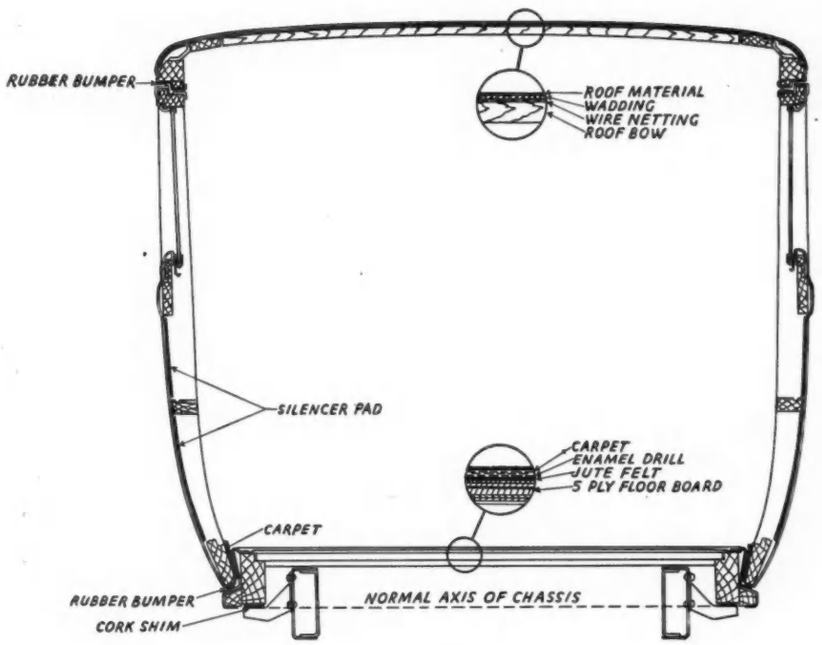
Aside from the lower prices, and the change to twelve-cylinder engines in the larger cars, there are new bodies throughout the line, many mechanical improvements, including a new free wheeling unit effective in all speeds, a synchronized shift frame mission, a new box girder type frame structure, a new system of engine mounting, and shock absorbers adjustable from the driver's seat, or "ride control." Startix is also standard equipment, eliminating the starter button.

Instead of being mounted on the frame side channel flange, the body is mounted on outrigger brackets riveted to the frame web in such a manner that the



Sills of the new Pierce-Arrow bodies are vertical and the body is mounted on outriggers on the neutral axis of the frame giving more body room. Note also the box section side rail, which extends back to the center cross-member + + + +

be Followed by Twelve-Cylinder Models



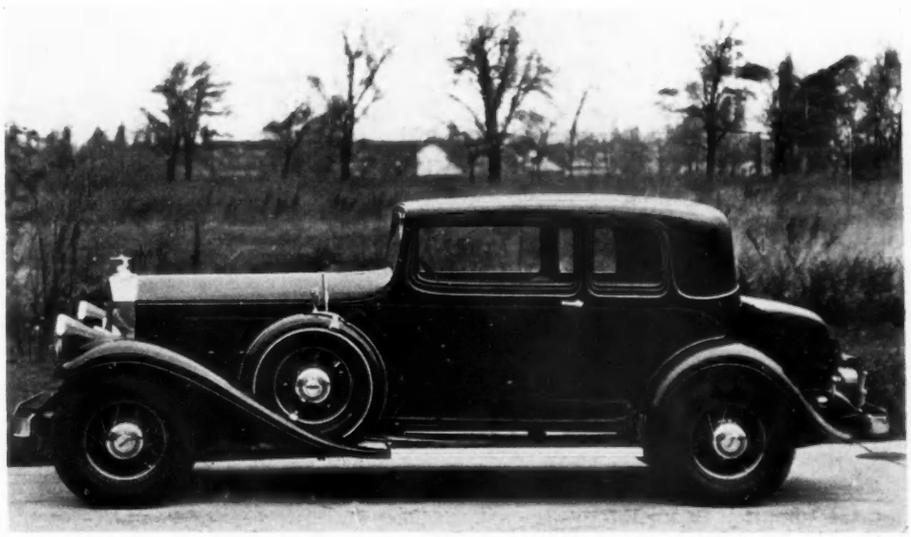
There has been no sparing in the effort to silence Pierce-Arrow bodies for 1932. This diagrammatic view shows the different types of materials used + + + +

bottom of the body sills are along the "neutral" axis of the frame, where there is a minimum of distortion. Further, the body sills are not of the horizontal but of the vertical type so that strains are more readily absorbed and a stronger construction is obtained. In connection with the widening of the bodies the rear wheel tread has been increased.

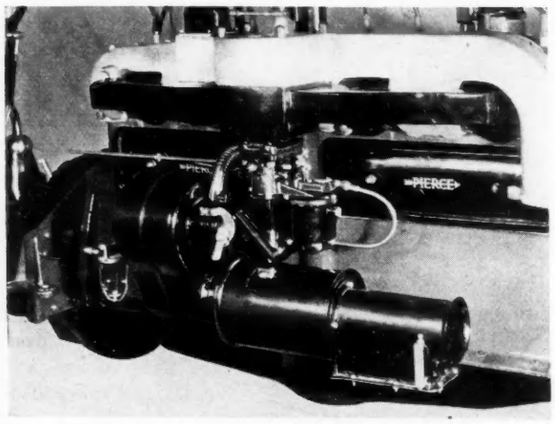
The accompanying sketch shows the various layers of material which are used to insulate the body interior against noise, heat and cold. Pedal and control inclosures are surrounded with sponge rubber and felt pads for sealing purposes. Ventilators are provided with screens to keep out bugs, etc.

The changes in body lines on the eight-cylinder chassis are more easily seen in the accompanying photograph than they can be described. A few details, however, are worth mentioning. The new V-shaped radiator shell is chrome-plated, including the shutters and the false bottom or upper part of the splash shield. There are two chrome-plated horns. Front frame horns are neatly inclosed in sheet metal stampings lacquered to match the fenders. In fact, much attention has been given to smooth out all sheet metal work and inclose chassis parts.

Additional work has been done in the direction of obtaining the steadiest front-end construction possible. The radiator core, which is now flexibly mounted on the box-type cross-member, at a single point, is provided with heavier X-type bracing from the cowl. The hood further adds to the radiator bracing. The radiator in turn is provided with connecting struts to the headlamps and fenders, so that there is a direct



Side view of the brougham on the 1932 Pierce-Arrow eight-cylinder line. It lists at $2,385, Pierce-Arrow's lowest-priced model ever offered + + + +



A Burgess type muffler or intake silencer has been added to the air intake system of the Pierce-Arrow eight + + +

tie-up of the entire front end to the body cowl. The latter has been heavily reinforced internally, in such a manner that the sheet metal of the cowl itself is not called upon to supply much of the stiffness required for a good result.

With heavy fender braces to the frame, in turn, the front end of the Pierce-Arrow should be as steady as any car on the road. Of course the frame itself also plays an important part in this result. From the center cross-member forward to the front spring horns, the frame channels are of complete box section, built up by cold riveting and arc welding (at various points) two opposed channel members, one inside the other.

In addition to this, the center cross-member has also been changed to a box section, while a new cross-member has been added just to the rear of the transmission, first, in order to carry the rearmost powerplant support, and second, to offset the reduced engine bracing effect resulting from the increased amount of rubber for the engine supports. Also with this point in mind, the deepest section of the frame side-rail has been carried well forward, to a point ahead of the front kick-up.

The eight-cylinder engine mounting already mentioned is rather hard to classify. There are two points of support at the front, but these are close enough together, so that, torsionally, they will function as a single point mounting. At the rear end of the cylinder block, on each side, there is a forked arm or bracket extending to the frame side rail with two rubber cup type mounting insulators for each bracket. Another forked arm is found attached to the underside at the rear of the transmission, with two more rubber cup insulators between the arm and the new cross-member previously mentioned. Actually there are eight points of engine support in the frame, although, considering the engine in torsion, the effect is the same as a three point mounting. The rubber insulators are quite large, and the rubber is unusually soft, to provide the maximum of engine insulation from the frame and body.

Further changes in the eight-cylinder powerplant include the adoption of the latest type of Nelson Bohnalite pistons, the use of a two-point Whitney chain for the front-end drive, the adoption of a three-bladed fan of high efficiency and quieter operating characteristics, the adoption of an integrally cast flywheel and bell housing to insure good alignment, etc., the addition of a Burgess type of intake silencer at the carburetor, just back of the cold air intake, retained from last year; covering of the forward part of the exhaust pipe to reduce under-the-hood temperatures and chances for vapor lock; location of the fuel line outside the frame side-rail for the same reason, and insulating the fuel line where it is exposed under the hood; and a change in the oil slinger hole location in the connecting rod to the trailing side.

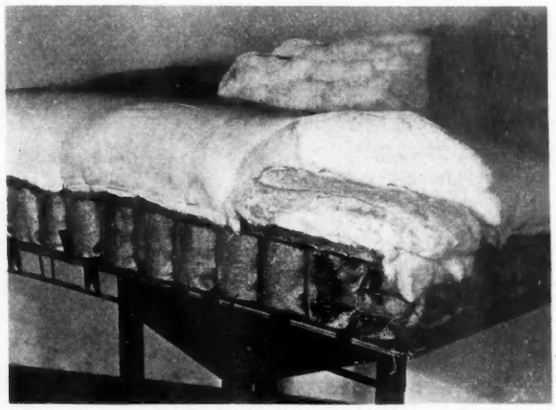
In the exhaust system also, there are now two mufflers, mounted in tandem. The forward unit is lined with mica, the rear muffler containing steel wool. Back of this there is the fish-tail type of exhaust pipe used last year.

In the amidships section, as has been mentioned, there has been considerable change. The free wheeling unit has been removed from inside the transmission and placed at the rear. It is also of a new design, using eight single rollers, instead of the former triple roller construction. The cam on which these rollers ride has also been changed. It is now of such a shape (practically an involute) that the wedge angles have been materially reduced (2 degrees), reducing slippage thereby, while easy disengagement is provided by the shape of the cam which makes the disengagement angle somewhere around 6-8 degrees. In the former design the wedging angles, etc., also would vary for each of the three rollers, causing uneven take-up.

In place of the free wheeling unit in the transmission, a cone clutch synchronizer, also furnished by Warner Gear Corp., has been adopted. The shift is effected in the following manner. The first movement of the gearshift lever toward either second or high engages the cone clutches, synchronizing the gear to be engaged with the dog clutch which is to engage it. As the pressure on the shift lever increases, the pressure between the cone clutch halves also increases, until sufficient pressure is supplied to cause a series of radial ball locks (under spring pressure) to release, permitting the dog clutch to engage, and the cone clutch to disengage.

Control of the free wheeling unit has been simplified by locating the control lever on the dash, to the right of the instrument panel, next to the ride control regulator lever. Here it is readily accessible, and the control

(Turn to page 764, please)



The construction of the Pierce-Arrow is interesting in the evident effort to provide the maximum amount of comfort + + + + + + + +

Just Among Ourselves

A Contract for Protection

C. A. VANE, following through with his usual thoroughness on the campaign he has been waging for a contract which will better protect the automobile dealer, has published his idea of a sound contract worked out to the last detail. It warrants, and doubtless will get, careful study by executives of all vehicle-manufacturing companies.

We haven't studied it enough yet to permit intelligent comment. Its publication does bring back to mind, though, a very old thought about dealer contracts and dealer-manufacturer relationships, namely, that satisfactory relationships probably never can be attained by purely legal means.

Changes in the present contract can give to a retailer a bit more protection than he now has, but it is probable that the actual intent of the factory will always be more important than the terms of the contract in determining whether or not a given dealer gets fair treatment or a gypping in a particular case.

Save Daylight for Business Talks

WONDER if you'd be interested in a good detailed outline of our stock market losses, our present holdings, and the depreciation which they represent, and what we think about the economic effects of the current and future political situation? Would you?

We don't think you would. Yet if we were to come into your office and start to give a similar dissertation you'd probably be polite enough to let us run on for quite a while—at least until you could decently break and get under way on a good story of your own trials and tribulations along similar lines. You'd tolerate our conversation only because you were eager for the pleasure of having someone listen to yours.

And for the same reason you *wouldn't* read a page of wailing wall posters on the same subjects.

Sob Exchanges Are Pure Waste

THE honest fact is that nobody today actually is interested in the stock market troubles of anybody else. Yet hours of good daylight time are still being consumed every day by otherwise intelligent business men in crying on each other's shoulders about personal gambling troubles as a preliminary to more immediately important business talking and action. And this goes for contacts inside as well as outside your own company.

Next time you begin to wring out your crying towel on the desk of some chap to whom you've gone on a business mission during business hours, just remember that his encouraging smile is not in appreciation of the pleasure of listening to your gloom, but in anticipation of being able to tell you his in a few moments.

Nine Years' Supply in U. S. Oil Wells

IN the midst of an era of oversupply of petroleum, one is brought up short and is a bit startled to find so important an oil executive as Valentin R. Garfias, manager, foreign oil department, Henry L. Doherty & Co., calling upon the petroleum industry to conserve its output today in order to avoid a shortage of domestic petroleum within the next decade. It has been common lately to stress the need for limitation of petroleum production to make possible prices at which the industry could operate profitably; but the bugaboo of exhaustion of domestic petroleum resources has not been brought clearly before us for nearly 10 years now.

Garfias quotes W. E. Pratt to the effect that: "The petroleum industry is in the throes of overproduction, but there is no suggestion of an oversupply in sight. Our trouble is not that we have found too much oil, it is rather that we insist on producing tomorrow's oil today. . . . In spite of overproduction, new supply is actually lagging at the moment."

Garfias goes on to produce figures which would indicate that "all the known oil reserves in the United States available, even at reasonably high prices, would be exhausted in nine years if called upon to supply the entire needs of the American market." He goes on to voice the opinion that "it is clear that long before this time elapses the American oil industry will feel the result of curtailed domestic supplies and will have to rely more and more on foreign oils."

Even though these rather startling statements come from an executive of a company headed by the man generally known as a stormy petrel among other executives of his industry, they warrant attention by their very difference.—N. G. S.

Hypoid Rear Axle Gears Call for

Series of experiments made at the General Motors Laboratories show how these lubricants operate and throw light on effect of sulfur in lead-soap lubricants and acids in castor oil + + + + + + + +

WE are accustomed to think of lubrication as a condition in which a film of oil prevents the rubbing surfaces from coming into contact with one another, and thus prevents wear. That this condition actually exists in well-lubricated bearings is well known; but it is not so well understood that this conception of lubrication does not apply to highly loaded gears. In well-lubricated bearings the loads rarely exceed 2000 lb. p. sq. in. projected area, and the rubbing speeds are generally high enough to maintain a film of oil which separates the bearing and journal. In automobile gears the pressures between gear teeth reach values as high as 400,000 lb. p. sq. in., with rubbing velocities ranging from 0 to 300 ft. p. m., and this between convex surfaces which are poorly adapted to maintain a lubricating film. It is inconceivable that even the most viscous oils and greases can be retained between the surfaces of the teeth in a sufficiently thick film to prevent metallic contact, particularly when it is realized that operating temperatures of over 210 deg. Fahr. are common. With these conditions prevailing, it is not difficult to imagine that we are fast approaching the limit of capacity of ordinary oils. The fact that we are not now in difficulties can probably be attributed to the intermittent nature of the loading, which permits time for temperature equalization between periods of load.

A type of rear axle gear known as hypoid has been on the market for a number of years, and with such gears it has been found necessary to use special lubricants. This is not because the hypoid design carries higher loads than the spiral bevel gear; the difference is simply one of rubbing velocity, which in the hypoid design is somewhat higher than in the spiral bevel type. Since scoring is due to a combustion of load and speed, with consequent high temperatures, it follows that for equal loads the scoring conditions will be reached in the hypoid design earlier than in the spiral-bevel types of gears. However, it is only a matter of relatively slight changes in gear dimensions before the spiral-bevel gear will also be in scoring difficulties. Even now it is possible to score conventional spiral-bevel gears under extreme conditions of inertia load, such as can be developed by use of the modern fast-shifting transmissions.

Since it was improbable that any ordinary oil or grease was capable of maintaining a fluid film between gear teeth, an investigation was directed toward the problem of preventing galling or scoring between heavily loaded sliding surfaces. This work was originally done on complete rear axles in a dynamometer set-up, in which it was possible to reproduce conditions of seizure between the differential pinions and pin identical with service failures that were at that time occasionally found in certain districts. This was done by locking one wheel and taking the load through the differential. This test, however, was slow and expensive. A special machine was, therefore, built which approximated the essential parts of the axle test, i.e., a hardened steel pin rotated in hardened steel bushings, the assembly

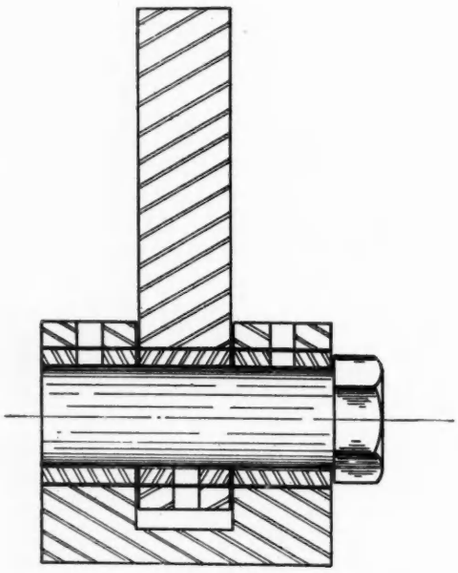


Fig. 1
Assembly of journal-bearings - retainer - link

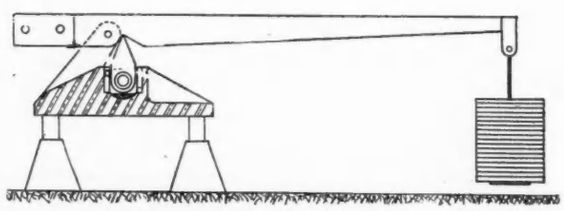


Fig. 2
Complete assembly of testing apparatus + +

"Extreme Pressure" Lubricants

by H. C. Mougey
and J. O. Almen*
General Motors
Research Laboratory

being immersed in the oil to be tested. The details of this machine are shown in Figs. 1 and 2. Fig. 1 shows the journal and bushings mounted ready for test. This assembly is immersed in an oil bath, as shown in Fig. 2, which also shows the loading means. The journal is then rotated by means of a dynamometer from which the torque required to rotate the journal can be determined.

The usual method of operating this machine is to rotate the journal at 100 r.p.m. with a constantly increasing load of 1000 lb. per sq. in. projected area applied every 10 seconds until a total load of 25,000 lb. per sq. in. is reached or until seizure occurs. In operating this testing machine, it was found that when we made tests with ordinary lubricants with steel against steel, at certain loads and speeds, seizure or scoring resulted; but it was also found that seizure could be prevented if another metal was substituted for steel as one of the wearing surfaces, for example, steel against bronze. Tests established that there are a number of metals and alloys that could be substituted for bronze and operated against steel, and still avoid the difficulties that occur with steel against steel; but there is the objection to most of these metals that they are low in strength and are not suitable as gear materials. We found that by means of electroplating different metals on steel we could get the benefit of the wearing surfaces of the plated metal and the strength of the steel backing. We also found that by mixing finely divided metal powders with the oil we could get the same results as if the metals had been plated on the bearings, with the exception, however, that we could not keep these powders in suspension for any length of time. Very much to our surprise it was found that we could operate steel against bronze and certain other metals with no lubricant whatever using loads and speeds that would result in seizing or scoring, if we used steel against steel with any of the ordinary oils or greases.

In Fig. 3 curves are shown of tests in which steel journals were operated against steel, bronze, or tin-plated steel with no lubricant whatever or with various lubricants. In this figure, the vertical lines on the test of steel on steel with mineral oil and with the tin-plated journal dry indicate seizure of the journal and bushing. The others completed the test without seizure.

There remains a serious objection to the use of plated metals for high-loaded moving parts in that, if the plate should be worn off in service, the steel would then operate against steel with unsatisfactory results. If a lubricant could be developed which would form on the surface of the steel a film or plate with a low coefficient of friction, similar in effect to that of the film or plate of electro-deposited metal, and if this film or plate would be reformed automatically

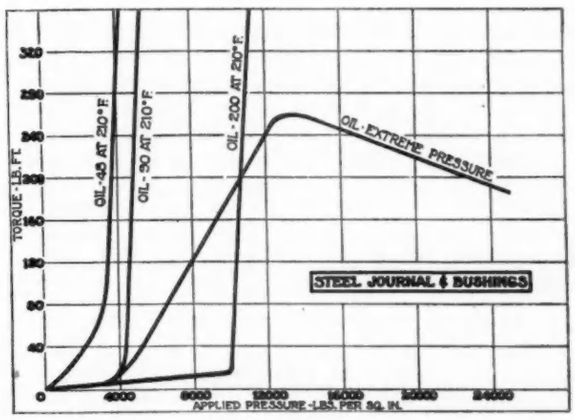

OIL - 45 AT 210° F.
OIL - 90 AT 210° F.
OIL - 200 AT 210° F.
OIL - EXTREME PRESSURE
STEEL JOURNAL & BUSHINGS
TORQUE - LB. FT.
APPLIED PRESSURE - LBS. PER SQ. IN.

Fig. 4 (Above)

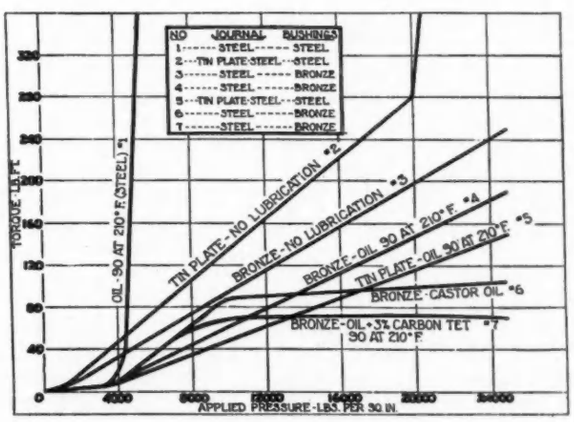

NO JOURNAL BUSHINGS
1 STEEL STEEL
2 TIN PLATE STEEL STEEL
3 STEEL BRONZE
4 STEEL BRONZE
5 TIN PLATE STEEL STEEL
6 STEEL BRONZE
7 STEEL BRONZE
OIL - 90 AT 210° F. (STEEL) *1
TIN PLATE - NO LUBRICATION *2
BRONZE - NO LUBRICATION *3
BRONZE - OIL 90 AT 210° F. *4
TIN PLATE - OIL 90 AT 210° F. *5
BRONZE - CASTOR OIL *6
BRONZE - OIL + 3% CARBON TET 90 AT 210° F. *7
TORQUE - LB. FT.
APPLIED PRESSURE - LBS. PER SQ. IN.

Fig. 3 (Left)

*Paper presented at the Twelfth Annual Meeting of the American Petroleum Institute at Chicago. Slightly condensed.

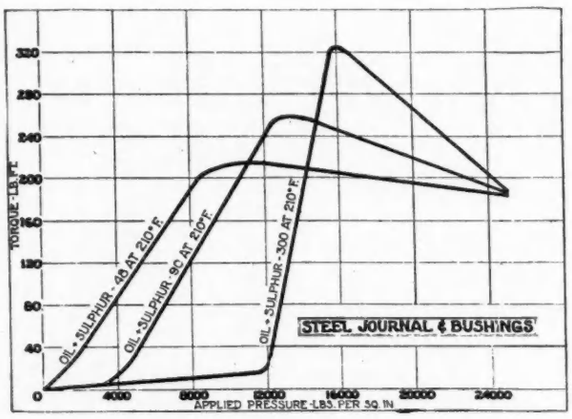


Fig. 5

as it is worn off in service, this might be a solution of the problem. We believe that some such phenomenon enables the so-called "extreme-pressure" lubricants to operate. In Fig. 4 are shown results obtained with three ordinary mineral oils and one commercial "extreme-pressure" lubricant. The mineral oils have viscosities of 48, 90, and 200 at 210 deg. Fahr., respectively. The "extreme-pressure" lubricant has a viscosity of approximately 90 at 210 deg. Fahr. It will be noted that viscosity effect is quite marked, in that the 200 viscosity oil shows a low friction up to 10,000 lb. per sq. in., at which point the oil film fails with a consequent rapid rise in friction, and that the oil films with the lower viscosity oils, as would be expected, fail at much lower loads. Since the initial oil temperature in these tests was about 70 deg. Fahr., it is evident that in service where temperatures of 200 deg. Fahr. are common, even the heaviest oils are incapable of sustaining very high loads. The heaviest oil shown in Fig. 4, if heated before the test to 200 deg. Fahr., thus reducing the viscosity, will give results similar to an ordinary engine oil tested cold. In the case of the "extreme-pressure" lubricant, the curve indicates it behaves exactly like any ordinary oil so long as the oil film is maintained.

Mediums Different from Oil

The addition of other materials to the oil does not affect the characteristics until the oil film has failed, whether the oil be light or heavy; but at higher loads there is a sudden transition from one friction level to another. These results indicate that lubrication at this higher friction level is accomplished by some medium having properties different from oil as used in ordinary film lubrication.

In Fig. 5 are shown three oils with viscosities of 48, 90, and 300 at 210 deg. Fahr., respectively; but these oils have all been sulfurized. It will be noted that in the "extreme-pressure" region the friction is approximately the same for all three oils, but an interesting difference occurs in the transition region in that the maximum friction is least for the light oil and greatest for the heavy oil. However, by reducing the viscosity of the heavy oil by the addition of light oil or kerosene, the point of maximum friction can be lowered. We believe this indicates that the film which carries the load in the "extreme-pressure" lubricant region is caused by chemical action requiring heat, and that this high friction shown by the heavy oil results from the layer produced by chemical action not having enough time to form before it is required to carry the load. For a number of years, lead-soap lubricants have had the reputation of carrying higher loads than ordinary mineral oil lubricants. We tested in our laboratory commercial lead-soap lubricants, and found that some of them had this superior load-carrying ability and that others did not. In trying to find the reason for this difference, we analyzed and tested many commercial lead-soap lubricants, and made and tested many others. Very early in our work we found the presence of large amounts of sulfur in the successful lead-soap lubricants, with usually much smaller amounts of sulfur in the ones which did not carry the extreme loads. This, together with the knowledge that flowers of sulfur has long been used to overcome over-heated bearings, and that sulfur oil is extensively used in cutting lubricants, suggested that sulfur was the active ingredient in successful lead-soap lubricants. We made experimental mixtures where we added sulfur to mineral oils low in sulfur, and found that by this addition the oil was able to carry the heavy loads, whether lead soap was present or not. We added lead soap to mineral oils low in sulfur, but we were never able by this means to improve the load-carrying ability; although in some cases, when we added lead soap to oils which were high in natural sulfur, we obtained superior load-carrying properties.

Lead Soap and Castor Oil

Lead soap added to sulfur-free mineral oil does not seem to increase its load-carrying ability, but lead soap added to pure castor oil does make an "extreme-pressure" lubricant which works effectively beyond the range of castor oil. Lead soap added to a mineral oil containing enough sulfur produces an "extreme-pressure" lubricant that seems to make the transition from "fluid-film" lubrication to "extreme-pressure" lubrication with less friction and heat than a sulfurized mineral oil without the lead soap or other materials which might help in the transition range.

In testing these lubricants, we found that when these successful lead-soap lubricants were operated under conditions where mineral oil without these additions could not carry the loads, in all cases except that of castor oil plus lead soap, the surfaces of the steel were covered with a black film, which analysis indicated to be iron sulfide. In the case of castor oil plus lead soap, we believe the acids in the castor oil have an action similar to that of sulfur. These investigations indicated that the superior load-carrying properties of "extreme-pressure" lubricants were due to the formation of a separating film not of oil but of some material formed directly on the surface of the steel. This theory is similar to that which is held by many investigators seeking to explain the peculiar oiliness properties of animal and vegetable oils and mixtures of these with mineral oils. If this were true, it would be necessary for an oil to contain chemically active material to function as an "extreme-pressure" lubricant, and it seemed likely that other materials than sulfur should have similar properties. To test this theory, we went to the chemical stockroom and selected a large number of chemicals, and tested them as lubricants for extreme-pressure conditions. We found certain esters, such as benzyl benzoate, dibutyl phthalate, etc., which have chemical structures more or less analogous to animal and vegetable

oils, which gave lubricating results in our tests comparable to animal and vegetable oils. In general, this type of material will give a lower coefficient of friction than ordinary mineral oil when tested under conditions that are slightly too severe to permit the operation of a mineral oil, but it usually fails to carry the real extreme pressures.

Among the most interesting of the materials that may be used to increase the load-carrying capacity of lubricants is chlorine in various forms, such as carbon tetrachloride, etc. When such material is added to ordinary oil in quantities from 1 per cent up, the test results are quite startling, as shown in Fig. 6. In testing some of these compounds, we found that iron chloride was formed on the surface of the steel; and it is our belief that the superior load-carrying ability of these chlorine-containing materials is due to their action in forming iron chloride on the steel, which apparently acts as a separating film capable of sustaining extreme loads. A striking example was the case of dichlarethyl ether. This is a very fluid material of about the consistency of gasoline. It boils at 349 deg. Fahr., and from its physical appearance it certainly would not be selected as a high-load-carrying lubricant.

Dichlarethyl in Lubricant

In our tests, this material, in its undiluted state, was found to be equal to the best "extreme-pressure" oil or grease ever tested by us in its load-carrying ability and low-friction characteristics; and at the completion of the test small amounts of iron chloride could be scraped from the container in which the test was made, although the steel wearing surfaces appeared to be unaffected, and as smooth and bright as when the test was started. This test appeared to demonstrate that the viscosity of the lubricating oil is of little importance as regards its load-carrying ability in the extreme-pressure region. Tests of commercial lubricants have shown that there are on the market a number of lubricants for which great claims are made and which contain various chlorine compounds.

One of the best lubricants tested was a 10 per cent solution of soap (sodium oleate) in water. This material gave a lower friction and a better appearing journal at the end of the test than any other lubricant we have tested. The results of this test are shown in Fig. 6. In contrast to this, the same amount of sodium soap added to mineral oil, and subjected to the same test gave results comparable to ordinary mineral oil of high viscosity. These tests emphasize the importance of the body of the lubricant as a cooling medium as well as that of a carrier of the chemically active material. Since high-pressure lubricants appear to act chemically, care should be used to select such materials as will be active when needed, but not corrosive or active when they are not required to develop this property. Too much attention should not be paid to empirical laboratory tests to determine these properties. There has been a wide commercial use of sulfur-containing lubricants, especially those used for cutting oils; and yet it would be easy to develop laboratory tests that would indicate such sulfur-containing lubricants would be dangerous from a corrosive standpoint. Attention should also be called to the fact that under conditions where ordinary mineral oil is satisfactory, such as fluid-film lubrication, it is

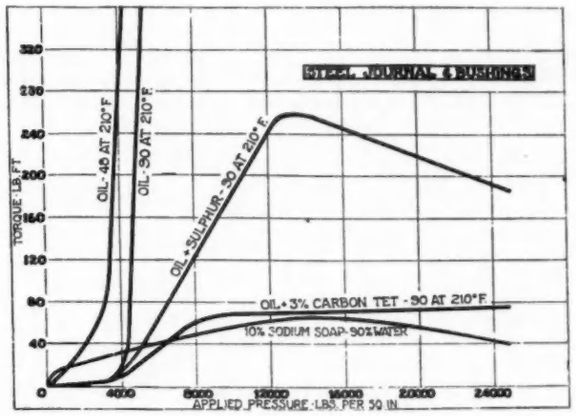

STEEL JOURNAL & BUSHING
OIL - 46 AT 210°F
OIL - 30 AT 210°F
OIL + SULPHUR - 30 AT 210°F
OIL + 3% CARBON TET - 30 AT 210°F
10% SODIUM SOAP-90% WATER
TORQUE LB.FT
APPLIED PRESSURE LBS. PER SQ IN.

Fig. 6

usually impossible to show any improvement due to the addition of these chemically active materials. In addition, a lubricant may be an "extreme-pressure" lubricant when used with one combination of metals and under certain conditions, and yet it may be only an "ordinary" lubricant, or worse, when used with other combinations of metals or under other conditions.

There is a large potential market for "extreme-pressure" lubricants; but before this market can be developed, certain factors must be recognized and difficulties introduced by them overcome. The large automobile companies cannot put out designs requiring special lubricants until the oil industry generally is in a position to supply them and until tests are developed by which the satisfactory lubricants can be distinguished from the unsatisfactory ones. As previously mentioned, roller and ball bearing companies at the present time are opposed to extreme-pressure lubricants as a class, as they maintain that they cause rapid wear on roller and ball bearings. Until this situation is cleared up, the large automobile companies cannot take advantage of the extreme-pressure lubricants. It is evident that until designs calling for extreme-pressure lubricants are produced and distributed in quantity, the volume of business in "extreme-pressure" lubricants for automobiles is necessarily limited.

THOSE engaged in Diesel engine development will be interested to learn that proposals for the adoption of oil-electric drive on British railways were submitted some time ago to the Ministry of Transport, the Chancellor of the Exchequer and members of the government. The scheme is intended as an alternative to a proposed electrification of British main-line railways. It is claimed as one of the advantages of the Diesel-electric system that its cost would be only £150,000,000, as compared with a cost of £340,000,000 for main line electrification. It is figured that dividends of 15 per cent could be earned on the capital outlay required for oil-electric equipment, as compared with 6½ per cent on the capital necessary for main-line electrification. The fuel for the oil-electric locomotives would be obtained from British coal either by low-temperature carbonization or by hydrogenation. Another advantage claimed for the oil-electric drive is that the system could be introduced throughout the country at one time.

Continuous Liquid Heating and Conveyor

New system produces wheel hubs with fewer rejects, meeting rigid schedule at a considerable saving over former method + + + +

ALTHOUGH many manufacturers face distribution problems that far outweigh production ones, those directly associated with automobile makers are still concerned primarily with economic production. The automotive parts manufacturer falls in this group. His distribution problems are confined to a dozen or so direct contacts. His concern lies, of course, in production methods that will enable him to produce parts at the lowest possible costs under mass-production methods . . . with a certainty of meeting schedule requirements on time.

The Kelsey-Hayes Wheel Co., with several plants in Detroit and other cities here and abroad, is a typical example of the manufacturers in this group. The Kelsey-Hayes problem is almost entirely one of production. To meet the demands of their customers production must be uninterrupted and efficient. Every possible economy must be practiced to the limit. They are constantly alert for new and better methods.

The installation of continuous liquid heating, a new development, in the Kelsey-Hayes plant, exemplifies to what lengths this company is modernizing. The new continuous liquid heating equipment is used in the hardening of rear wheel truck hubs in the Military Avenue plant at Detroit.

Under former conventional methods the wheel hubs were lead-hardened by the batch method, utilizing manual labor. This method was slow, cumbersome and unreliable. It was a real restriction to the volume production necessary. Obviously the method of heat-treating was behind the high state of efficiency that had been developed throughout the plant.

Production officials of Kelsey-Hayes realized that in these hand methods of hardening lay the real deficiency. In cooperation with Surface Combustion Corp. engineers a careful analysis was made. It was found that the difficulties of hand operation not only could be eliminated, but that it would be possible to utilize the conveying system of the plant, providing an uninterrupted flow of operations through the heat-treating department down to the finish grind. It was also demonstrated that by a more accurate control of hardening it would be feasible to utilize the forging itself as the outer race for the wheel bearing.

After the possibilities and advantages of continuous liquid heating were clearly outlined, Mechanical Handling Systems, Inc., Detroit, conveyor mechanisms experts, were secured to cooperate with Surface Combustion Corp. engineers in the synchronization of the continuous furnace unit with the conveying mechanism of this department.

The Surface Combustion furnace was designed for a capacity of 90 hubs per hour at a bath temperature of 1600 deg. Fahr. to 1670 deg. Fahr., while the combustion chamber temperature below the pot is approximately 1950 deg. Fahr.

The lead pot used for hardening is 21 in. wide, 15 in. deep and 90 in. long, supported on cast-iron top plates by means of flanges cast integral with the alloy pot.

The furnace is fired with surface combustion diffusion and tunnel-type burners, adapted to a supply of 530 B.t.u. gas.

The material-handling mechanism is designed to coordinate with a production of 90 hubs per hour. Hubs are placed in a specially designed carrier (Fig. 1) which is removably suspended from the furnace conveyor. The conveyor takes the hubs through a preheater. They are then lifted automatically over the

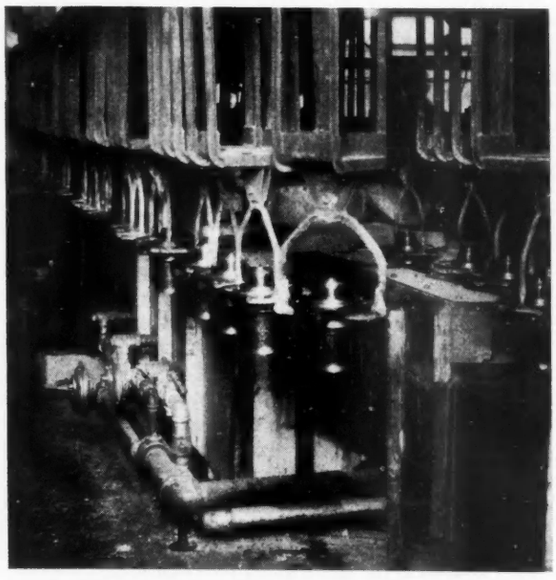


Fig. 1—Method of transmitting hubs to preheating zone

System Replaces Five Men and Saves Floor Space

by W. Gordon Park
Works Manager,
The Kelsey-Hayes Wheel Co.

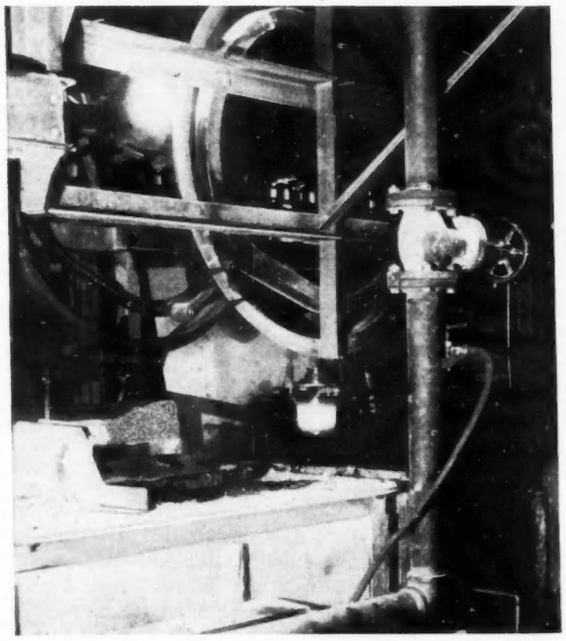


Fig 2—Lifting cams which handle hubs through lead furnace

lead pot and immersed as in Fig. 2. The hub remains in the furnace 197 seconds.

The hub is then lifted out of the furnace and placed on a stationary support which suspends the hub 3/8 in. on the lower end in the oil bath. The oil bath cycle is adjustable—from 1 to 5½ seconds. At the end of the predetermined time the hub and carrier are removed from the oil bath station and transferred to a caustic soda spray head. As the hub is set down on the spray head, a valve is automatically opened and the inside of the hub is sprayed. At the end of 29 seconds the hub is removed from the spray head and the flow of the liquid automatically cut off.

The carrier and the hub are replaced on the conveyor in a water bath, having been lifted over the side of the tank by means of a transfer mechanism. Here the hub is completely immersed. After remaining in the bath approximately five minutes, the carrier and hub are removed from the conveyor, lifted over the end of the tank and replaced on the conveyor. The hub is then removed from the carrier for inspection of hardness and the final grind. The carrier continues on the conveyor for another cycle.

The transfer mechanism consists of five pairs of rotating arms, so designed that they will pick up the hub carrier, lift it up and advance it about 36 in., replacing it on the conveyor or on stationary supports. The operation of the arms is intermittent, rotating 720 deg. in 12 sec. on a time cycle of 40 sec.

The starting and stopping of the arms are accomplished by means of limit switches operated by the conveyor.

The results of this development in continuous liquid heating were even more outstanding than anticipated by the designing engineers.

The labor of six men, under the old batch method, was reduced to one man who merely checks temperatures, timing, and the functioning of the conveyor system. By concentrating the equipment a great deal of floor space is saved. The inaccuracies of the personal element in the heat-treating under batch methods have been entirely eliminated. Rejects are negligible, approximating 1 in 300 hubs. The entire unit is portable to facilitate changes in plant layout, expansion,

(Turn to page 770, please)

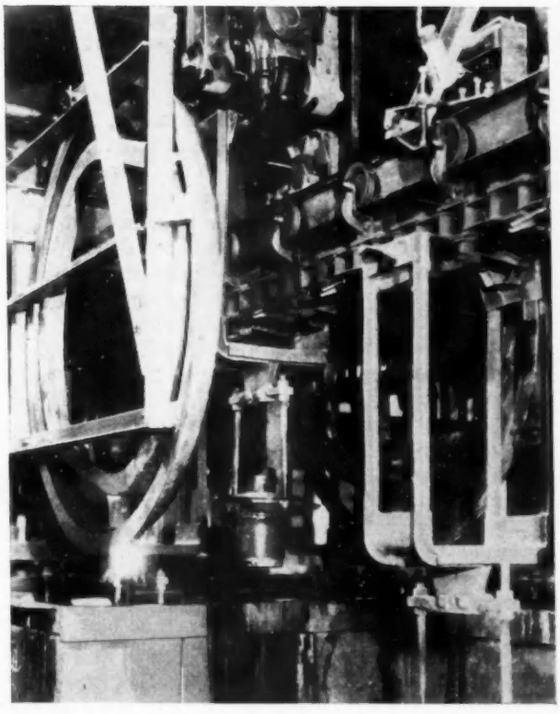


Fig. 3—Close-up of mechanism lifting partially treated hub from lead bath

Growth of Automotive Industry Based on Foreign Trend

(*Continued from page 749*)

portion of total outside registrations has likewise increased, from 4.1 per cent in 1924 to 5.0 per cent in 1930. Registration-population ratios are of little aid in this instance because the great mass of the population are not even potential purchasers of automobiles. Only in the Union of South Africa can some indication be given of the extent of saturation. Approximately 149,000 cars were registered there in 1930, which would be one car for every 46 people. Moreover, if the figure is computed on the basis of the number of Europeans, it shows one to every 11.5 people. This seems to indicate a further use of motor vehicles.

"The position of the American exporter is further strengthened because his product meets market needs better than that of the European producers. As in Oceania, the poor highways, long distances to be traveled, and the lack of ready repair service call for a sturdy and relatively high-powered car. European cars do not fill the needs of the market as well as those produced in America.

"Then, there is little likelihood of local production of parts and accessories which in other parts of the world have caused a dribbling away of our export trade. Only bodies are being manufactured, and these but in limited quantities. A 10 per cent protection is afforded local producers [in one case], but this is hardly sufficient to force importers to use bodies which are locally manufactured. American exporters have little to fear from local production of automotive products within Africa.

"Ability to purchase motor vehicles is also greater than in some other regions because the initial cost has not been raised to a like extent through the imposition of increased tariff charges. In the Union of South Africa, for instance, the duty ranges from 20 to 25 per cent ad valorem based on domestic market value on complete units and is only 10 per cent if the body is made entirely within the Union. The rates in many other parts of Africa are equally low or lower. Taxation of automobiles is also reasonable, for the amount assessed ranges from £3 to £5 annually. Both the tariff and taxation conditions can be considered as favorable to further automotive development."

Asia. "Asia with its great extremes in type and stability of government, economic development, and standard of living presents a difficult problem for anyone who would attempt to predict the extent of future motor vehicle use. And yet no other continent has a greater need of better transportation facilities and at the same time is less developed from an automotive standpoint. This indicates that in time these vast, densely populated regions of the Far East may use motor vehicles in large numbers. Yet, in spite of untoward conditions, registrations in Asia have more than doubled since 1925, and the proportion of total outside registrations which are found in Asia has increased from 5.5 per cent in 1924 to 6.7 per cent in 1930. Continued growth can be expected, but widespread use of motor transportation will await political and social improvements.

South America. "The use of motor vehicles has increased more rapidly in South America since 1924 than in any other part of the world. In a five-year period registrations more than trebled. As a result of a more rapid growth than in other sections, the percentage of total outside registrations found in South America increased from 7.1 per cent in 1924 to 9.0 per cent in 1930. Rapid expansion such as this might not presage further expansion if it had created a saturated condition in the market, but this does not appear to be the case in South American countries. Argentina in 1930 had about 366,000 cars, one to every 29 people, or about one-sixth as many in relation to population as in the United States; and yet Argentina is a nation with a purchasing power level which is estimated at two-thirds to three-quarters of that in this country. Difference in purchasing power alone, however, will not explain the divergence noted in the registration-population ratio. Brazil with a registration in 1930 of 200,000 cars had one to every 201 people; but 80 per cent of the population cannot be considered potential buyers, at least for some time to come. Their purchasing power permits only of the bare necessities of life. So a better comparison would be between present car use and 20 per cent of the population; this would yield a ratio of one car to every 37 people. Chile has one car to every 120 people; Uruguay, with conditions much like those in Argentina, has one car to every 40 people. Although immediate conditions are not favorable to rapid expansion, yet in the opinion of the writer South America is only on the threshold of its automotive development; and, what is of equal significance, the United States in all likelihood will continue to be the dominant source of automotive supply.

"Even in view of the adverse influence of tariff and taxation policies the unsaturated condition of the market coupled with potential economic progress appears to justify the conclusion that automotive imports will increase markedly within the next decade, and these imports should be supplied in large part by exports from United States factories."

Herbert Hosking.

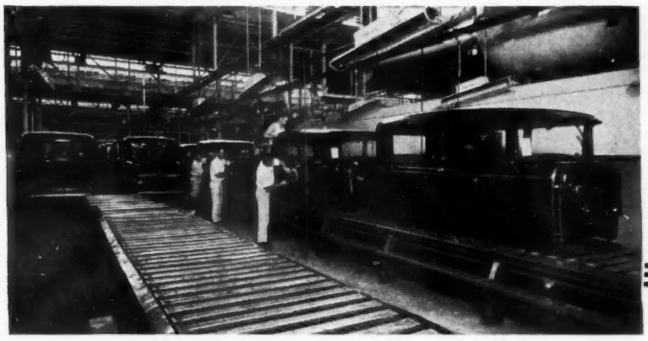
Pierce-Arrow Brings Out New Eight

(*Continued from page 756*)

handle is sufficiently large, and the movement required sufficiently great to make the handling easy. Also, the position of the lever readily indicates whether or not the car is free wheeling. Furthermore, the free wheeling unit is so designed that shifting into reverse not only locks out the over-running clutch, but that if the control lever was originally in the free wheeling position, the return of the main gearshift lever to neutral will also bring back the over-running clutch to the free wheeling condition.

The ride control consists of a linkage which regulates the size of an orifice in the Delco Products shock absorbers. The adjustment is infinitely variable, a needle valve type of construction being used in the shock absorbers for the regulating means, so that anything from a minimum control (for boulevard ride) to the maximum of resistance required (for high speeds on rough roads) can be obtained.

Further chassis changes include the adoption of larger brakes, with 16-in. drums. The latter are supplied by Kelsey-Hayes and are of two-piece construction assembled by the Lincoln arc-welding method. The drum proper is ribbed for cooling and strength.



PRODUCTION LINES

Production lines of the industry No. 6
Giving bodies the final polish. View of line in new Ford assembly plant at New Orleans + +

Our Hat's Off To—

James W. Hook, president of The Geometric Tool Co., for his plan to keep men employed during a depression. This plan is actually in practice. It's something for every industrial executive to ponder over.

"Recently our payroll department calculated from the percentage figures already obtained what would have been necessary in the way of reserves to have maintained the wages of our stable group of employees in office and shop at 80 per cent of normal for those with dependents and 60 per cent of normal for those without for 52 weeks of short-time work. It was quite amazing to us to find that such a reserve would have amounted to but three-quarters of one per cent of the payroll for the years 1923-1929, inclusive. During the same period our company provided in other reserves an equivalent of 13½ per cent of the same group of payrolls. If our experience is at all representative it would seem that industry can well afford to tide its stable group of employees over extended periods of depressed business. It is an obligation, I believe, that industry should voluntarily assume." —From an address delivered at the first conference on the management problem of the smaller industries.

Welding Lead

Some good dope on welding lead is found in *Oxy-Acetylene Tips*, Oct., 1931. Here are some of the high spots:

"The dull gray surface appearance of lead is due to a coating of oxide and other compounds that must be carefully removed before welding. In welding lead, hold the blowpipe so the flame is perpendicular to the surface of the work, and with the inner cone almost touching the surface of the metal, heat the lead until it just melts, then lift the blowpipe quickly in order to prevent excess melting. The blowpipe flame is directed on the metal for an instant and quickly flipped away. In this way it is possible to control this easily fused metal. Light lead sheet with flanged edges may be welded without the addition of rod, but for most work additional metal is required. Welding rod may be made by cutting sheet lead into strips or by melting lead in the vee of a short length of angle iron to form a bar of the size desired.

Knowing Costs

Surprising how many people are using standard costs. By that or some other name. Accurate figures judiciously used have cut paper work. And give a better picture of the operation. In jobbing shops and parts plants where quotations on new work are frequently made, the scheme simplifies and speeds up the work. Moreover the quotations appear to be safer and more accurate.

Well Ground

From *Carboloy* (Vol. 4, No. 2), we get some hot tips concerning the grinding of cemented-tungsten-carbide tools. Here they are:

1. That lighter feeds be used for the harder grades.
2. That softer wheels be used for the harder grades.
3. That wheels be dressed frequently to keep them from glazing and heating the work.
4. That care be used while clamping in vises and that no unnecessary tapping be done on the Carboloy or even on the shank.
5. That if a coolant is used, be sure it is a heavy flow.
6. That no Carboloy should be dipped in water for cooling purposes during grinding.
7. That grinding should not be done continuously in one spot.
8. That the wheel spindle on any type of grinder be kept snug and free from vibration.
9. That wet grinding is a safeguard and should be used wherever possible.

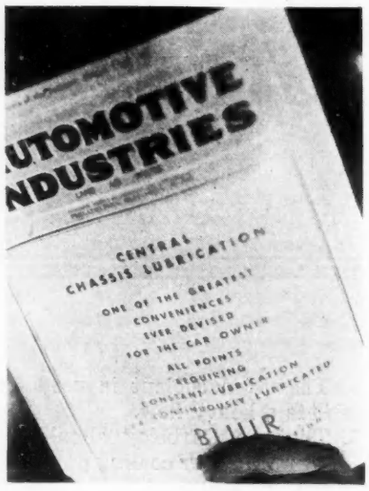
Needed Standards

Recent research in machine shop practice directs attention to the need for standards of machining finishes. Perhaps this may be the missing link between drafting and shop practice. R. E. W. Harrison of Cincinnati Grinders started the ball rolling last year. His contribution was a beautifully conceived procedure for standardizing grinding finish. Along comes R. C. Deale (*Mechanical Engineering*, October, 1931) with a scheme for standardizing practically the whole gamut of machining finishes, such as milling, turning, planing, threading, etc. Here is food for thought. Looks like a job for the S.A.E. Production Activity.

Identifies

Just tried a sample of Multilac through the courtesy of the Penene Corp. It's a new marking ink. Comes in black and opaque orange. Will write with a steel pen on hard, glossy surfaces, such as glass, steel, enamel, etc. After setting for several minutes to dry it will stick so tenaciously that it won't rub off in handling. Looks like a simple way of marking tools, dies, laboratory vessels, castings, and the like.—J. G.

MANUFACTURING MANAGEMENT METALLURGY



The Forum

A Word From the Buying Public

Editor, AUTOMOTIVE INDUSTRIES:

Very often when one reads the utterances attributed to some of the shining executive lights of the industry, one feels the urge to become a self-appointed champion of the automobile-buying public, and to give these same executives an idea of how the dear public feels about it all. Usually, upon reflection, comes the sobering thought, "What's the use?"

Now, however, it is Mr. Warner's most excellent article in your issue of Oct. 31 which prompts one to venture a few observations as a member of that dear public.

Mr. Warner makes the suggestion that automobile manufacturers of today are "eager to listen to public demand." With at least some members of the public, the expression of this thought invariably brings on an attack of hysterical laughter, from which the natural reaction is a state of deep cynicism during which the only desire of the subject is that he had the power to make a particular manufacturer drive one of his own products a few thousand miles under the same conditions as it is used by the subject.

Of course, "the customer is inarticulate except when he buys the product," but even if he is willing to be or perhaps actively desires to be articulate, who is there who is interested in his message? Certainly, not the dealer! The dealer is interested only in what he has to sell, not in what the customer wants. The usual attitude of the dealer is that the customer is a very lucky man to be able to get so much for so little money. Certainly, not the salesman! The salesman usually doesn't know what it is all about, anyway, and the only thing which can arouse the spark of any intelligent interest in him is the signature on the dotted line which assures him his 4 or 5 per cent. Certainly, not the service manager! He can tell you how "they are *all* coming through" with this little clutch peculiarity or that little motor idiosyncrasy, but his problem is only with things as they are, not with things as they ought to be.

Then the year rolls around, and we are treated to the thrilling moments of the annual show. Perhaps I shouldn't say "treated," when we pay our six bits, but anyway how thrilling it is to find so many people interested in what we want. There stands the product of our desires, all spick and span, with numerous gentlemen, some of them from the factory, all standing around eager to tell us all about it. We venture to ask a few questions, pertinent to us, but apparently not pertinent to the factory, because after a careful search through the little black book, we are told that we must "find the answer in the stars." This is the product of our demand, but they can't even answer an intelligent question about it.

Perhaps one shouldn't say such things. One should be content with the realization that this product is the result of his demand, and it should be impertinent to find fault with it. Like castor oil, one takes it for his own good.

Is there an answer? Most certainly! Mr. Warner suggests a few very good ones. The best place to get information is where the information is. Surprising as it may seem, there are many of the public who know what they would like to have but they never get a chance to tell anyone who is willing to listen. Why not get the reaction of a few sound members of the public *before* the model comes out rather than after? After it's out, the damage is done. With all due respect to the engineers, there are many times when they wouldn't be able to sleep if they knew what the public were thinking about how well they were satisfying the so-called demand.

P. H. GUILFOIL.

Preheating Fuel for Injection Engines

Editor, AUTOMOTIVE INDUSTRIES:

In the Forum for Oct. 10, attention is renewed on the preheating of the fuel for injection engines and even to the critical temperature. Some mechanical engineers might welcome statements by physicists and chemists regarding heating complex fuels to their critical temperatures.

In citing the use of precombustion chambers as "an attempt to preheat fuel to the burning point," no reference is made to the fact that such preheating occurs after the fuel has left the injection system. Probably the majority of high-speed oil engines have a separate injection plunger for each cylinder; it is possible that Mr. Richardson has overlooked consideration of the intake stroke of these plungers, however.

Concerning the statement, "Unfortunately the significance of many of the findings has escaped all students of the subject heretofore," two clauses in Mr. Richardson's letter could to advantage be clearer independent of the context: (1) "Evaporation started on ignition"; (2) "vaporization proceeds as fast as the fuel can be burned." Somehow these clauses suggest that combustion precedes vaporization. Perhaps no such confusion would occur to one who had not earlier in the year read the following statement in a paper of wide scope: ". . . concludes that vaporization plays no part in either the ignition or combustion in Diesel engines . . ."

To mechanical engineers, it is probably of more importance to know how oil should be burned for best results in an engine rather than to know how many ways there are, how many paths, by which carbon can pass into carbon dioxide.

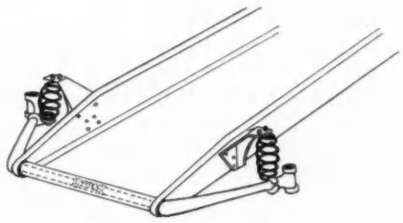
ROBERTSON MATTHEWS.

A New Suspension Method Is Offered

Editor, AUTOMOTIVE INDUSTRIES:

During the past two years I have read with interest the articles on various types of wheel suspension. I am inclosing a brief sketch and description of a suspension which may have advantages worthy of the interest of some of your writers.

The cross arm at the front of the frame is a tube rigidly attached to the side members. In this are bushings at each end and in the center. From the king pin of each wheel is an arm which fits into the front cross member and is free to oscillate in the bushings. Each arm is free to rotate independent of the other. To each side of the frame are riveted brackets. Be-



tween these brackets and the spindle arm is clamped a coil spring which carries the load of the front of the car to the wheels.

This arrangement allows the conventional wheel alignment, steering and braking systems to be used.

WM. T. HEYER.

About the Janeway Method of Calculating Bearing Loads

Editor, AUTOMOTIVE INDUSTRIES:

I wish to make some comments on the articles on "Calculation of Bearing Loads," by Robert N. Janeway, which appeared in *Automotive Industries* of May 30 and June 6, last.

First of all I wish to express my agreement with Mr. Janeway with respect to his expression $T_b - T_o = a\,p_s\,V$. While there may be objections to it from the point of view of the oil film, this expression is sufficiently correct for practical use. All technical calculations are based on hypotheses which are never quite in accord with practice, and the engineer must know, or at least have an idea of, the difference between the assumptions made and actual conditions. For instance, in calculating the strength of a beam, we apply a factor of safety which depends on how the load is applied, the possiblity of overload, and perhaps on the difference between minimum and maximum load.

In the calculation of bearing loads, an examination of the load diagram reveals this difference in a way. If the load varies much in direction and in absolute value, a small rubbing factor is chosen; whereas, if oil is supplied in large quantity and is well cooled, the rubbing factor may be large.

A disadvantage of Mr. Janeway's method is that it gives only the mean values of the forces during intervals of 30 deg. or 45 deg. of crank motion. As pointed out in his answer to Mr. Caminez, the direction of the forces is known, but we may object that only the mean direction for the 30-deg. or 45-deg. interval is known, and if we measure the 30 deg. or 45 deg. from the beginning of the firing stroke, the value and direction obtained are not representative.

The great advantage of the method is its rapidity and the possibility of employing non-specialists for the work. But let me make the following observations:

1. While complete calculation of a crankshaft is a tedious job, requiring weeks, the time is not entirely consumed in the calculation of bearing loads. A considerable amount of time is required for:

(a) Evaluation of the masses, not only of the piston and connecting rod, but of the crankshaft itself as well, the latter being not negligible, but of particular importance when it must be dependent on the results of the calculation.

(b) Calculation of the stresses in connecting rods, crankpins, crank arms and journals, when they must be exactly known.

2. For the determination of these stresses an exact diagram of the crankpin loads is necessary.

3. For the determination of the points of maximum stress, the main-bearing load diagram is very useful, since it permits of immediately eliminating certain portions of the cycle which will obviously not give very high stresses.

4. If we use Mr. Janeway's system (which commends itself where results are wanted quickly), it is obvious that if later it becomes desirable to calculate the stresses, all the work already done is useless for this part of the problem.

The conventional method, which is tedious, of course, can be, to an extent, simplified without affecting its exactness.

If we draw the crankpin path and, for 15-deg. intervals, the 24 position points of one revolution, we can draw the resultant force (inertia force plus gas pressure force) with the point itself as origin. This will be obtained by:

(a) Calculation of accelerations, by the graphical method.

(b) Multiplying these accelerations by a factor which depends on crank velocity and the mass of the piston and part of the connecting rod.

This operation will be done directly, all accelerations being projected on a straight line, the angle of this line with the axis of acceleration being so chosen as to give the force on the desired scale.

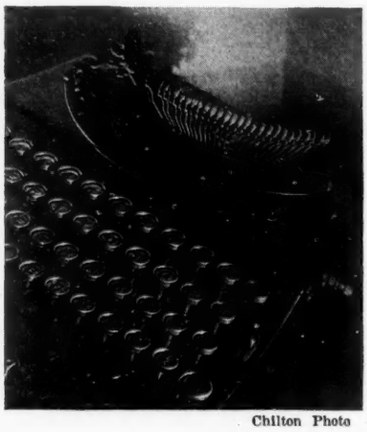
(c) Drawing the pressure cycle.

(d) Multiplying the pressures by a factor which depends on piston area.

This operation will be done directly, all pressures being projected on the O-pressure axis, with an angle so chosen as to give the force on the same scale as under (b).

Next, we draw a diagram of forces, the origins of which are not the center of crankshaft, but the position points themselves.

If we now draw at each point a vector representing the centrifugal force on the connecting rod big end, in a direction opposite to that of the force itself, the line joining the ends of the two vectors at each point will represent the resultant force on the crankpin, with its exact direction. But all the ends of the centrifugal force vectors are on a circumference, concentric with the crankpin circumference.



Chilton Photo

We can now continue the operations as follows:

(e) Draw a circle, concentric with the crankpin path, and a radius chosen to give a distance to the position points equal to the centrifugal force on the connecting rod big end.

We now have the same diagram as in (d) except that the origin of each vector, instead of being the position point, is a point on the new circle which is on the same radius.

To obtain a main-bearing load, we combine the forces as by the conventional method, but without paying attention to the centrifugal forces.

These are added by drawing a circle with the necessary radius, in the same way as for the big-end force. But let us observe that the new origins are not necessarily on the same radius as the position point, but may make with this radius an angle that is easily determined.

This is particularly advantageous for a preliminary calculation. If the rubbing factor is too high, the length of bearing must be increased. Then a new big-end force must be applied, and this addition is immediately made. If the crankshaft has counterweights, the effect of these can be shown by drawing one or more circles. For instance, a six-cylinder crankshaft does not give the same bearing loads if counterweights are placed on a journal-crankpin arm as if they are placed on a crankpin-crankpin arm. The best counterweight is the lightest, giving the desired rubbing factor, and its value can be easily determined by this method.

For cases requiring hurry, it is possible to use the following method which gives fairly close results. Offset of the cylinder is disregarded, and a fixed connecting rod ratio, 1: 4 for example, is used in all cases.

The inertia diagram is then the same for all cases, only the scale being different. A standard diagram can be used for the crank revolution not affected by gas-pressure forces.

For the remaining portion of the cycle, when the gas pressure forces must be considered, the following approximation is taken advantage of:

(c) All gas-pressure forces are proportional to the maximum gas pressure force. Therefore, a number of standard diagrams (of inertia plus gas pressure) can be constructed once for all, these differing only by the ratio of maximum inertia force to maximum gas-pressure force.

In fact, since the two forces are interdependent to a large extent, it will not be necessary to construct many such standard diagrams.

The time taken to get the crankpin diagram is reduced by choosing that one of the standard diagrams which gives nearly the same ratio as in the actual case, or, if time permits, interpolation can be effected between the two standard diagrams with ratios immediately below and above that of the actual case. The centrifugal force circle is then drawn.

The time is reduced to the strict minimum of measuring forces and summing them up, which cannot be avoided with any system.

The diagram so obtained can be used to determine the stresses in crankshaft, if desired, and this calculation is then made with the same approximation as the bearing-loads calculation.

Let us now see the effect of these approximations:

(1) Is used by Mr. Janeway, too, and, in fact, is not important.

(2) Is permissible with all engines having about the same connecting-rod ratio.

(3) Is justified because it introduces no appreciable error when gas pressures are high, and determination of the gas pressures for the end of the expansion stroke by means of the equation for the polytropic curve, the exponent for which is rather uncertain, produces errors of the same order. Moreover, these forces are added to inertia forces, which are many times greater.

The connecting-rod ratio and the form of cycle are comparable for all modern conventional engines, and the error is negligible.

For special or racing engines, this error may become appreciable, and in such cases approximative methods must be avoided.

In conclusion, I wish to say that I prefer the process of combining bearing loads by the clamped-beam method to that by the simple bearing method used by Mr. Janeway.

I wish to thank Mr. Janeway for having given a pressure cycle, his Fig. 6. His work on combustion-chamber design gives special value to what he recommends for use in this connection.

PAUL PUVREZ,
Liege, Belgium.

Moves for the Credit of University of Nebraska

Editor, AUTOMOTIVE INDUSTRIES:

I have just noticed the write-up in the September 19th issue of *Automotive Industries* of the dynamometer car for testing farm tractors built by the Institute of Agricultural Engineering at Oxford University.

This write-up seems to indicate that this car is original with Oxford University. Whoever wrote it was evidently ignorant of the fact that the first car of this kind was built by the Agricultural Engineering Department of the University of Nebraska, at Lincoln, to be used in the tractor tests which were required by State law passed by the State Legislature in 1919.

This car which we built was built on a tractor chassis and used an electric generator for load. A Burr dynamometer consisting of a hydraulic cylinder and recording unit was used to measure the draw-bar pull. Copies of the plans of this machine were requested from several sources, including Oxford University. It is, therefore, evident that this machine is not original with Oxford.

O. W. SJOGREN,
Agricultural Engineer,
Supervisor Research & Development,
Killefer Mfg. Corp., Ltd.

Engineers Fight Poison Gas and Riding Discomfort at Bus Session

Ventilation, body design, legislation, as well as the coordination of railway and highway transportation, were subjects brought up at Annual S. A. E. Meeting + + +

by George T. Hook

WHEN W. C. Naegel, chief engineer of the Bender Body Co., and G. H. Scragg, of the Mack company, bus-session speakers, had finished reading papers which approached "relations of the motorcoach body and chassis to each other" from their respective viewpoints, it was difficult for this writer to see anything in their statements which attendees of the annual S.A.E. Transportation Meeting could make an issue of. And, as a matter of fact, it wasn't in construction influences that operators were interested. Improvement in passenger comfort was the big thing on their minds and, completely disregarding the papers during the discussion period, they formulated questions that bore pertinently on what was eating them. And it must be admitted that in every case engineers had forward-looking answers.

For instance, E. S. Pardoe, superintendent of bus operation, Capital Traction Co., Washington, D. C., queried why something hasn't been done regarding bus ventilators. Odors and noxious gases were so troublesome, he said, that they put their ventilators to tests and determined that at no time did they oprate at more than 50 per cent of efficiency. Mr. Naegel explained that, in his opinion, ventilators were constructed to operate at maximum efficiency at 25 m.p.h. bus speed. Since the average city-type bus goes only 8 to 10 m.p.h., that's the reason for ventilation troubles in city-type buses. Nobody undertook to reason why ventilators weren't constructed to attain maximum efficiency at the known average speed of a city-type bus instead of at a speed which it seldom reaches, but that, probably, is merely another problem for the ventilator manufacturer.

The problem must be solved. The answer, Mr. Scragg speculated, may be power-driven ventilators "because present-type side, rear and top ventilators have all had their disadvantages in failing to perform a thorough and satisfactory job."

Again this is a case of eliminating the effect instead of the cause. But a ray of hope was shed by Dr. H. C. Dickinson, chief of the heat and power division of the Bureau of Standards, which eventually may illuminate the way for engine designers to scotch poison-gas and odor troubles at the source. He said he had had favorable results by introducing a column of air into the exhaust manifold and thereby completely oxidizing the exhaust. A heated column of air, observed, gave better results, and results were poor at idling but satisfactory at high speeds. One way of heating the air, he explained, was by means of the muffler. In this regard he had an idea that certain patents would have to be looked into.

Weight per seat on shortest wheelbase is what operators are most interested in, according to A. H. Gossard, vice-president in charge of automotive transportation of Midwest Utilities Co., Chicago. Moreover, "manufacturers in the future should give greater consideration to wind resistance. Bodies must be designed to cut it down in the interest of more economical operation." Pointing to another need, he predicted: "We've had heating devices, but the time will come when cooling devices ought to be considered in order to effect passenger comfort, which is one of the reasons for bus acceptance."

Streamlining for Speed—Cooling for Comfort

If the attitude of one engineer may be considered typical, more than one member of the engineering tribe made a mental note of bus comfort improvement possibilities with the intention of giving them deep consideration.

A summary of 1931 truck legislation, which was thorough, exhaustive and—believe it or not—interesting, was presented by Pierre Schon, sales engineer of General Motors Truck Co. This writer seriously questions whether there is another man in the truck industry who has made as meticulous a study of restrictive truck legislation and its effects as Mr. Schon. His analyses, therefore, carried with them authority. After presenting charts displaying the wide variation among states of size and weight restrictions, Mr. Schon cited the effect of this variation on manufacturers.

"As vehicle manufacturers are compelled to con-

form and change their designs to meet this great variety of constantly changing state laws, production economies cannot be effected due to limited quantities of certain types of vehicles salable in only a few of the states. Dormant markets cannot be cultivated due to legal restrictions in sizes and weights preventing the sale of heavy-duty vehicles in over 20 states. Maximum economy in operating costs cannot be obtained by operators because they are prevented by legislation from using the most economical type of equipment." For these reasons, he concluded, "the time, obviously, has arrived for the S.A.E. to take action and give serious consideration to assist in setting up a standard code of maximum limitations of sizes and weights of vehicles, taking into consideration:

1. Practical design limitations from the standpoint of the vehicle and tire manufacturers.
2. Safe and economical operation.
3. Limitations of pavement and bridge structure as set up by the U. S. Bureau of Public Roads.
4. Safety to the public on the highway.

Need of Uniform Legislation

This conclusion evoked the approval of F. K. Glynn, of the American Telephone & Telegraph Co. and chairman of the S.A.E. Transportation and Maintenance Activity Committee. He agreed that "the society should be ready to take some action to bring about some uniformity in delirious weight and size restriction legislation. We should consider how and what uniformity we can accomplish on a live-and-let-live basis."

Consideration of railway and highway transportation coordination brought a respected "enemy" into the automotive camp. It was S. O. Dunn, editor of *Railway Age*, who has won the admiration of his craft by his successful trumpeting of what we choose to call railroad propaganda. The arguments he lined up in favor of the railroad idea of coordination were the familiar ones which persons interested in this subject have read again and again and, as the doggerel poets say, read enow. Briefly, they are as follows:

"What is happening to railway transportation will also happen to highway transportation if the unwarranted and insane production of additional transportation facilities, utterly regardless of any need for them, continues unchecked. Coordination must be attained.

"Sound coordination means a process which will result in each means of transportation handling that traffic which it can handle at the lowest cost, with due allowances for differences in the quality of the different kinds of transportation service rendered.

"You can never have economically sound coordination of different means of transportation until those who render transportation service upon the highways, like those who render transportation service by railway, pay out of their own earnings all the costs incurred in enabling them to render their service. All the monies spent upon highways should be derived from motor vehicle taxes.

"Further, true coordination can be secured only by subjecting all means of transportation to similar regulation."

Answering Mr. Dunn's contentions, Mr. Scaife presented a paper fully as lengthy as Mr. Dunn's. Replying to his taxation argument, Mr. Scaife said: "If the public paid for the construction of the highways over which its trucks and buses operate, there is no reason why the public should charge itself an additional cost in the price of service over such highways simply because railroads are compelled to pay for their own right of way. I cannot understand why it is economically unsound for a taxpayer owning his own truck, handling his own produce over a highway for the construction and maintenance of which he pays taxes, not to have his costs increased because railroads must pay taxes on their own right of way." As to whether operators of buses and trucks actually do pay adequately for the use of the highways, Mr. Scaife referred Mr. Dunn to facts compiled in a 10-year investigation by the Bureau of Public Roads. Proceeding to regulation, he said:

"Does Mr. Dunn mean that 'true coordination can be secured only by subjecting all means of transporation to similar regulation,' or does he mean that similar means of transportation should be subject to similar regulations? Certainly Mr. Dunn does not believe that the horse and wagon should be subject to the same regulation as the freight train! Therefore, in discussing all of these problems as to taxation and regulation, it is necessary that an understanding of the use of the motor truck be arrived at before conclusions can be drawn as to what kind of regulation it should be subject to."

In commenting upon the effects of sound coordination, Mr. Dunn declared that in his opinion the result will be that "the railways will again become almost the sole long-haul inland carriers of the country; the trucks will retain and increase their terminal and short-haul business, and that rail-truck service will carry a large and increasing amount of traffic from the door of the shipper to the door of the consignee."

Heating System and Conveyor Replace Five Men—Save Floor Space

(*Continued from page 763*)

etc. Under the old method it was impossible to hold the uniformity of heat treat accurately enough from a production standpoint to utilize the forging as the other race of a roller bearing, where tolerances cannot exceed ‡0.0003 in. This was effectively accomplished with this new equipment. Lead carry-off was also reduced with the continuous method.

This furnace is operating 23 hours per day, the only time lost being a half hour at midnight and noon. The installation has been so successful that a duplicate extra unit is being constructed to take care of increased production requirements. The extra equipment will be put in operation shortly.

A NUMBER of different alloys of base metals are now being used for industrial thermocouples, instead of the original platinum and platinum alloy couples. An investigation recently made showed that all of these commercial couples, viz., Chromel-alumel, copper-advance, and iron-constantan couples, can be welded satisfactorily with the acetylene torch. The chromel-alumel couple was welded with a small-tip neutral flame, a small amount of brazo flux being used, while the copper-advance couple was welded with a very small flame and without flux.

AC Vacuum Pump Booster Offered for Windshield Wipers

HIGHER average road speeds, with more full-throttle operation, the opening up of intake manifolds for increased power, and the increasing use of passenger cars in the winter time have in recent years contributed to the difficulties of maintaining consistent vacuum windshield wiper operation.

To meet these conditions, AC Spark Plug Co. has introduced a combination fuel and vacuum pump. It is to be found on the 1932 Buicks described elsewhere in this issue. Instead of being used as the sole source of vacuum for windshield wiper operation, however, the pump is installed in the form of a booster, and the design is of such a character that the combined effect of the manifold and pump is to maintain a constant suction and to produce the same number of wipes per minute over the entire range of throttle opening and speed. Fig. 1 shows the new unit. It will be seen that the vacuum pump operates similarly to the fuel pump, except that the cycle is reversed. Spring S produces the suction stroke, while the discharge stroke is produced through the motion of arm D.

When manifold vacuum is high, the diaphragm R and lever Y are pulled away from rocker arm D at point B, so that only a partial stroke is effective to increase the vacuum in pump chamber T. When the wiper is not in operation, the diaphragm is depressed regardless of manifold vacuum. With the wiper functioning, the diaphragm movement increases as the manifold vacuum drops.

Fig. 2 is a comparison of the wipes per minute for full throttle operation and part throttle conditions, comparing the result from manifold vacuum only with that produced by the pump alone and by a combination of the two. When the windshield is subjected to snow, sleet, etc., the maximum suction available at the highest manifold vacuum is provided over the entire range.

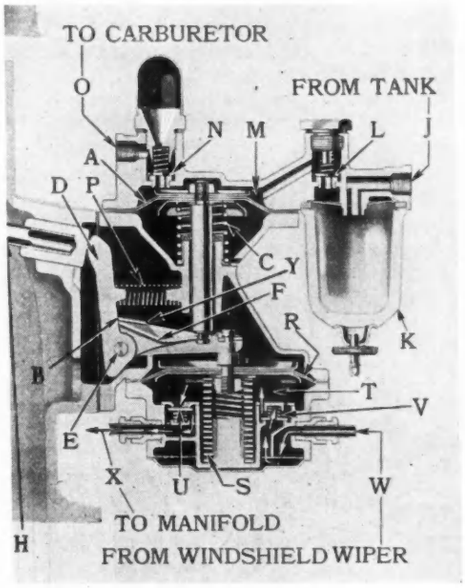


Fig. 1 (Above)—Sectional view of AC combination fuel and vacuum pump on Buick 1932 models + +

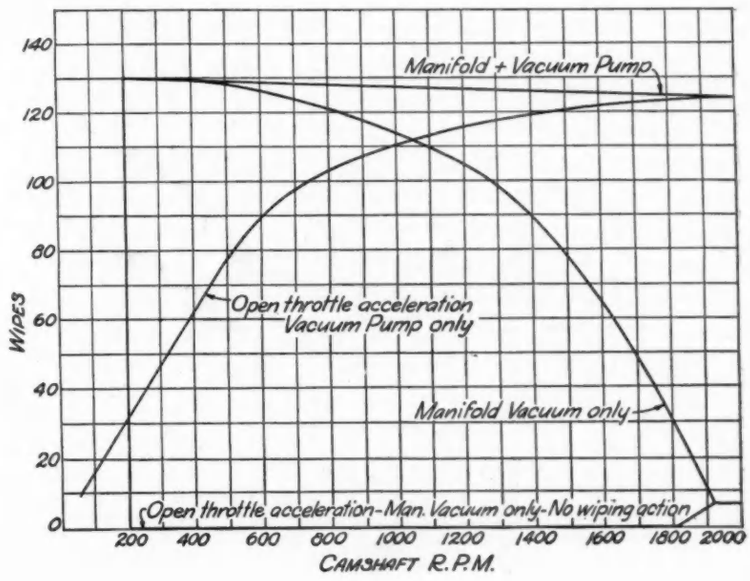
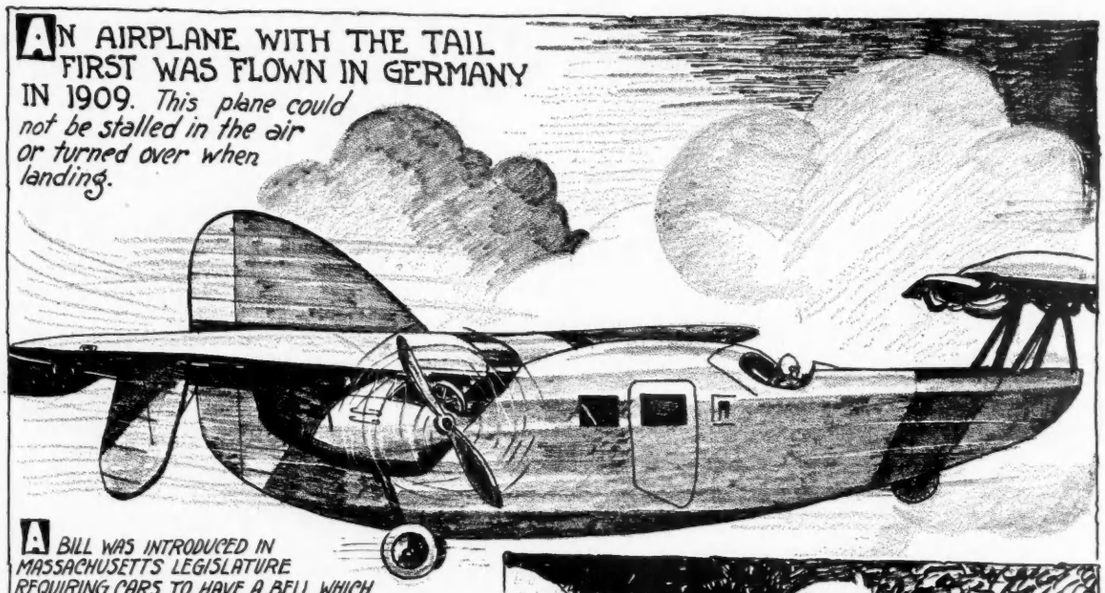


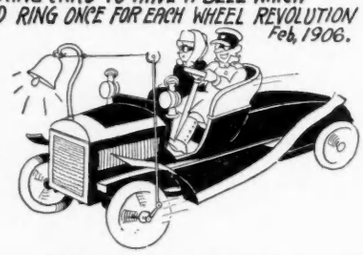
Fig. 2 (Right)—Action of two-blade windshield wiper with AC combination fuel and vacuum pump Model F + + + + +

Automotive Oddities—By Pete Keenan

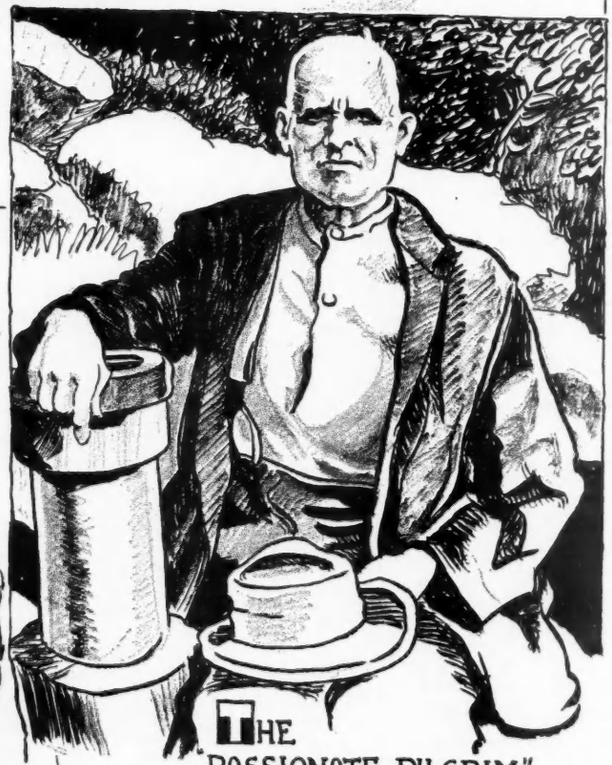
AN AIRPLANE WITH THE TAIL FIRST WAS FLOWN IN GERMANY IN 1909. *This plane could not be stalled in the air or turned over when landing.*



A BILL WAS INTRODUCED IN MASSACHUSETTS LEGISLATURE REQUIRING CARS TO HAVE A BELL WHICH WOULD RING ONCE FOR EACH WHEEL REVOLUTION *Feb, 1906.*



ALONZO STAGG, DEAN OF FOOTBALL COACHES, WILL DRIVE NOTHING BUT HIS OLD ELECTRIC RUN-ABOUT

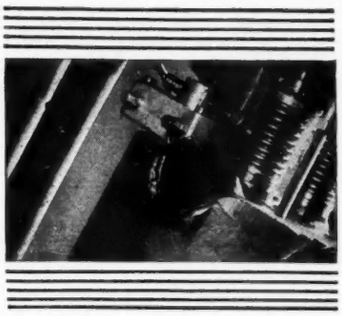


THE "PASSIONATE PILGRIM."

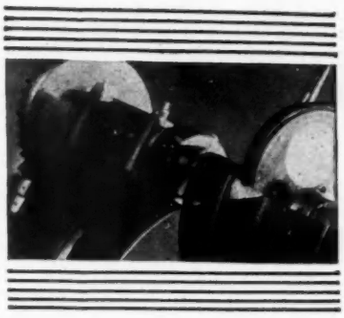
Sam Smith, who helped to drill the first producing oil well in the world makes a pilgrimage to it each year on the anniversary of its spouting. Titusville, Penna.

Do You Know An "Oddity"?

Correspondence about "Automotive Oddities" is invited. Contributions used will receive editorial mention when practicable. If you are interested in the source of, or the reason for, a particular "Oddity," ask the editorial department of Automotive Industries about it.



NEWS OF THE INDUSTRY



A. P. I. Hears Secretary Lamont

He Offers Plan to Petroleum Men

CHICAGO, Nov. 12—Unless a plan for cooperation between producing states is successful the oil industry faces Federal regulation of production, Secretary of Commerce Lamont told 1500 delegates to the twelfth annual meeting of the American Petroleum Institute at the Stevens Hotel here.

Mr. Lamont said selfish disregard of national interests may put the industry in a legislative straitjacket which it does not deserve. He offered a plan designed to place the industry on firmer ground. In this plan he proposed: an interstate compact approved by Congress putting on a permanent basis the periodical forecasting of demand; the settlement of state production quotas to meet that demand and the enforcement of such quotas; uniform state laws affecting drilling, wastage of gas unit operation, maximum recovery from ground and fixing minimum gas-oil ratios; a joint Federal and state fact-finding body as recommended by Secretary Wilbur for arriving at an equation of foreign and domestic productions and imports.

Amos L. Beatty of New York, a director of Phillips Petroleum Co., was elected president of the institute to succeed E. B. Reeser, Barnsdall Corp. The directors adopted a resolution authorizing a salary for the president, heretofore a post without remuneration.

The principle of imposing a tariff on the importation of crude oil and derivatives was approved by the institute's board and promotion and organization of committees in each state for combating gas tax exasion was authorized.

Uniform gasoline tax laws with "teeth" to solve the increasing problem of gas tax evasion were urged by William A. Mc-

(Continued on page 775)

MR. FORD continues to set the pace for amateur landholders with the purchase of 500 acres of muck land near Gladstone, Mich. The land will be drained and cleared by crews recruited from the unemployed, and workers in a new plant being constructed at Gladstone for Ford will establish better homes and gardens.

In case you haven't heard, the name of the company selling the new Rockne sixes will be the Rockne Motors Corp. Now that's what we call news.

John Scoville, Chrysler's statistician, has been checking over his famous occupational statistics of who buys Chryslers. In July of this year policemen bought 190 per cent more Chrysler products than they did last July, and are fourth in a list showing the percentage of increase by various occupational groups. Municipal and national government employees were second and third respectively, and engineers were first.

With 520 departures daily, either by air or combination air-rail to the 175 principal cities of the U. S., Canada and Mexico, Chicago is revealed as the aeronautical center of the nation, in an air transport survey just completed by United Air Lines.

New identification cards will be issued to purchasers of Illinois 1932 licenses. They will include a photostatic copy of the original application for license.

L. H. Steward, with a Lockheed Orion plane, with retractable landing gear, and Wasp motor, recently broke his own record for flying from Chicago to Washington, D. C. He covered the 632 miles in three hours and ten minutes. His average speed was 210 miles an hour and he hit as high as 246.

Use of stickers to check up on who in Chicago bought city license tags and who didn't, has brought results. Licenses have been issued to 407,868 medium priced passenger cars in the first 10 months of 1931, compared with 395,301 for the entire year of 1930. And anyone in the automobile business can testify that the increase is not in automobiles sold. The Bureau of Mines has completed preparation of a series of films showing all phases of motor vehicle manufacture and operation. They are available for free showing.—H. H.

THE NEWS TRAILER

Chevrolet Leads October Returns

Plymouth Shows Gain in Early Sales Figures

PHILADELPHIA, Nov. 12—Registrations of new passenger cars in October ran 34.8 per cent behind the same month last year in the first 17 states to report. Ford is off 55 per cent from 1930 in these states as compared with a 19.2 per cent decline for Chevrolet which continues in first place. Plymouth, however, is running 97.5 per cent ahead of last year.

On the basis of these partial returns, the national October sales total approximately 97,500 against 125,000 in Sept., 1931, and 150,000 in Oct., 1930.

Willys Sales Gain

TOLEDO, Nov. 11 — Willys-Overland October sales were 37 per cent ahead of September and 92 per cent ahead of same month last year, Harry B. Harper, vice-president, reports. November unfilled orders are the largest since June 2.

Chevrolet Ohio Recalls Men

TOLEDO, Nov. 11—Chevrolet Motors Ohio Co., making transmissions, has recalled about 150(workers and expect to go right through to Feb. 1, at least, on full schedule. Plant has been retooled for heavier transmission for new Chevrolets.

Motor Wheel Declares

LANSING, Nov. 12—In view of the fact that business on book and releases on hand for November and December show a sharp upturn as compared with conditions which have existed for the past six months, directors of the Motor Wheel Corp. Tuesday approved a dividend of 12½ cents per share on the common stock payable at the regular payment date, Dec. 10, to all stockholders of record at the close of business on Nov. 20.

Men of the Industry and What They Are Doing

Marmon Names Rogers

The appointment of A. J. Rogers as vice-president in charge of sales of the Marmon Motor Car Co., has been announced by G. M. Williams, president. Mr. Rogers also has been elected a director of the company, and takes over his new duties at once.

Mr. Rogers succeeds George C. Tenney, who has resigned the post of general sales director after an association of more than two years with Marmon.

Serving in various important capacities with Marmon since 1915, Mr. Rogers has been advertising manager for the last several months and also has worked closely with the Marmon sales department at the factory and in the field. In his new position, he will continue to have charge of Marmon advertising and promotional activities.

Haynes Leaves Franklin

The resignation of Frederick J. Haynes as vice-president and general manager of the Franklin Automobile Co., Syracuse, N. Y., has been confirmed from the executive offices of the company. H. H. Franklin, president of the organization, resumes the duties of general manager, relinquished when Mr. Haynes made his connection with the organization about a year ago.

Dunlop Elects Purvis

At a meeting of the board of directors of the Dunlop Tire & Rubber Goods Co., Ltd., Arthur B. Purvis was elected president to succeed Hon. E. B. Ryckman, K.C., M. P., who retired from that office in the company upon his appointment as Minister of National Revenue in the Federal Government. Mr. Purvis is also president and managing director of the Canadian Industries, Ltd., which have a large interest in the Canadian Dunlop Co. The other officers of the company remain as before.

Federal Names Thompson

John H. Thompson has been appointed branch manager in Detroit for Federal Motor Truck Co., according to Henry Krohn, vice-president in charge of sales of Federal. Mr. Thompson was a distributor for Federal in 1911, after which he was connected for more than 15 years with Maxwell-Chalmers and Chrysler.

Gatke Names Davis

Charles H. Davis has been appointed director of automotive sales and merchandising for the Gatke Corp., manufacturer of asbestos brake materials. During the past year Mr. Davis has been Detroit representative for the Covite Mfg. Co. of Detroit and Holland. He was for five years executive secretary of the National Automotive Parts Association.

Redman Receives Medal

Dr. L. V. Redman, vice-president of the Bakelite Corp., was awarded the Grasselli Medal, the American Society of Chemical Industry for 1931, at a dinner held in the Hotel New Yorker. In accepting the medal, Dr. Redman stated that creative science will lead to freeing the world from poverty.

Chrysler Names Carson

H. D. Carson, formerly a sales representative for the National Business Sales Division of the Chrysler Corp. in charge of the New York office, has been appointed manager of the New York region of the recently organized Chrysler Motors-Fargo Division.

Miller Rejoins FWD

F. C. Miller has rejoined the Four Wheel Drive Auto Co., Clintonville, Wis., as a member of the sales engineering staff.

Fargo Names Jackson

Frank T. Jackson has become regional manager of the Chrysler Motors Fargo Division, with headquarters in Atlanta.

Motor Wheel Reports Loss

DETROIT, Nov. 11—Motor Wheel Corp. reports net loss of $248,837 for quarter ended Sept. 30, against net profit of $51,418 for the same period of last year. Net loss for first nine months this year was $37,706 against a net profit of $1,032,024 for first nine months of 1930. The directors have declared a dividend of 12½ cents per share on common, payable at regular payment date, Dec. 10, to stockholders of record Nov. 20, disbursement being made from cash surplus, making the total dividend payments for this year $1.00 per share.

The corporation recently announced a new type of brake drum known as "Centrifuse," which has been developed after more than two years of research and experimental work and months of road testing. It is reported that sales amounting to several million of these drums have already been made for the 1932 car season.

The Lansing plants of the corporation have been revamped to meet increased production schedules on new types of demountable-at-the-hub wood wheels. The wire wheel division is also benefiting by increased production and the corporation is looking forward to a very satisfactory volume of business.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, Nov. 12—Business sentiment improved further last week under the influence of rising commodity and security prices. In commodity markets, the most impressive gains were scored by wheat, silver and petroleum, while both bonds and stocks responded by moving toward higher levels. Retail trade was stimulated by cooler weather, and there were scattered reports of more active industrial operations.

CAR LOADINGS

A slight increase in railway freight traffic is reported for the week ended Oct. 24. Revenue freight loadings in that period totaled 769,673 cars, showing an increase of 7954 cars above the total for the preceding week, but a decrease of 189,819 cars below that for the corresponding period last year and a decline of 364,687 cars under that for the same week two years ago.

RAW SILK IMPORTS

Imports of raw silk increased sharply last month, amounting to 70,490 bales, as compared with 48,040 bales in September and 65,594 bales in October, 1930. Deliveries to mills were also somewhat larger than in the preceding month.

CRUDE OIL OUTPUT

Average daily crude oil production for the week ended Oct. 31 was 2,431,250 bbl., as against 2,381,250 bbl. for the preceding week and 2,363,050 bbl. a year ago. Sharp advances in crude oil prices last week were accompanied by some tightening in wholesale and retail gasoline prices.

BUSINESS FAILURES

Business failures reported to Bradstreet's last week numbered 596, as against 533 a week earlier and 472 in the corresponding period last year. The total number of failures in October was 2017, as compared with 1765 in September and 1768 a year ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices stood at 68.3 last week, as against 68.5 a week and two weeks before.

BANK DEBITS

Bank debits to individual accounts outside of New York City for the week ended Nov. 4 were 25 per cent smaller than those in the corresponding period last year. The total for the year to date is 21 per cent below that a year ago.

STOCK MARKET

The stock market moved uncertainly during the early part of last week, but a strong rally appeared in the later sessions, carrying a large number of the leading issues to higher levels. The tone of the money market was somewhat easier than in the preceding week, partly, it was believed, on account of the reversal of the international gold movement toward the United States.

RESERVE STATEMENT

Discounts of the Federal Reserve banks declined $12,000,000 during the week ended Nov. 4. This decrease, together with a reduction of $83,000,000 in holdings of bills bought in the open market and an increase of only $1,000,000 in holdings of government securities, caused a total decrease of $93,000,000 in bill and security holdings. Note circulation increased $63,000,000 and reserves $30,000,000, while deposits declined $141,000,000. The reserve ratio rose from 59.9 to 61.5 per cent.

A. P. I. Hears Secretary Lamont

He Proposes Plan for Petroleum Industry Operations

(Continued from page 773)

Afee of the Standard Oil Co. of Indiana on the opening day of the meeting. Four steps for stabilization of the petroleum industry were advanced by president H. B. Reeser in the annual address. They are: curtailment of production; orderly liquidation of excess stocks; reduction of stocks, and development of new uses and markets.

"Consumption of petroleum products has been maintained the past year in the face of a decline in demand for other commodities," Mr. Reeser said, "but over-production has led to unsettlement of the balance between supply and demand and has forced prices to the lowest level in years." He discussed general industrial problems and took up the stabilization of industrial operations at large, saying the Swope plan is already guiding the petroleum industry to a great extent.

Oscar Sutro, chief counsel of the Standard Oil Co. of California, attacked the anti-trust laws, in one of the most eagerly awaited addresses of the institute. He said the Sherman law harmed trade and charged that public interest is being sacrificed. He asked that the "belt be loosened." His talk brought a protest from Henry L. Doherty, who stated that the industry would be split wide open if the question of anti-trust laws was taken up. Price-cutting was denounced by Edward G. Seubert, president, Standard Oil of Indiana, in an address read by E. J. Bullock.

Gasoline tax evasion throughout the nation was estimated at from 6 to 7 per cent of total collections by Clyde L. King, secretary of revenue of Pennsylvania, in a paper read by A. P. Delahunt, in charge of Pennsylvania collections. The waste and recklessness of the east Texas fields was criticized by Col. J. Lewis Thompson of Kilgore, Tex. The oil states advisory committee, meeting concurrently, has renewed its demand for a tariff on crude oil and in a resolution asks a duty on foreign fuel oils.

Briggs Reports Profit

DETROIT, Nov. 10—Briggs Mfg. Co., has reported net earnings of $524,643 after depreciation, Federal taxes, etc., for the quarter ended Sept. 30, equivalent to 26 cents a share on 2,003,225 no par shares, compared with a net profit of $508,357 or 25 cents a share in the second quarter.

Net profit for nine months ended Sept. 30 was $1,076,731 or 54 cents a share, compared with $4,533,526 or $2.26 a share in the same period last year.

Budd Demonstrates Flying Boat With Welded Stainless-Steel Hull

PHILADELPHIA, Nov. 10—What is probably the first stainless steel airplane was exhibited and flight-demonstrated at the Navy Yard here today. The craft which is aerodynamically a duplicate of the S 56 series Savoia Marchetti was constructed by the Edward G. Budd Company after the design of Mr. Eneas Bossi of the American Aeronautical Corp. It is an amphibian biplane provided with a retractable but non-disappearing landing carriage.

Two outstanding developments are reflected in the design of the plane. The first and most important is the practical elimination of corrosion, age hardening made possible by the use of stainless steel for all ship structural parts except interplane struts and wing covering. The second lies in the attainment of a very light hull made possible by a design deliberately aimed to provide skin flexing and a method of fabrication involving a new welding procedure. A secondary feature lies in the fact that stainless steel is non-magnetic and would reduce instrument interference.

The new welding procedure, which is an electrical process, is known as "Shot welding" and was perfected under the supervision of Col. E. J. W. Ragsdale of the Budd laboratories. It is claimed that the "shot" method does not affect the tensile properties or ductility of the stainless steel and that it lends itself readily to mass production methods.

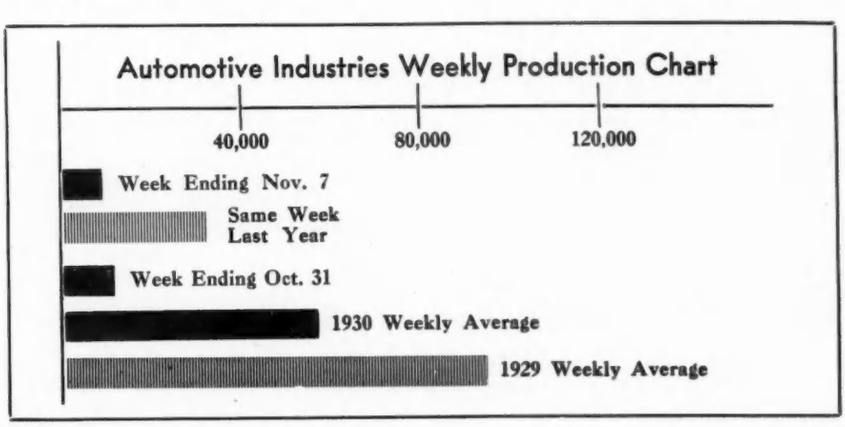
The fuselage or hull which follows the contour of the original wooden version of the Savoia Marchetti utilizes a series of longitudinal members extending along the bottom and sides. These members are approximately 5/16 in. wide spaced about 2½ in. apart and are of "U" section stainless steel approximately .020 in. gage. Placed at intervals along these longitudinals or stringers are bulk head cross frames or ribs. These cross frames are not interposed between the longitudinals and the outer skin, but are on the inside of the longitudinals. Small ears or extensions on the cross frames extend to the longitudinals where they are joined by welding. The outer skin is welded to the longitudinals. It will be thus seen that the hull metal covering is allowed considerable flexure between longitudinals and that the longitudinals proper are allowed some flexure along their length due to the method of joining them to the cross frames.

The hull skin has a maximum thickness of .020 in., which is at the step, other points top and bottom are .010, .012 and .016 in. The bottom is joined to the sides by a modified butt joint, an extra angle strip being inserted over which only the bottom skin is slightly beaded. The strip is then welded with the joint. All welded joints subjected to water are soldered over the weld to provide leak tightness.

According to statement of Budd officials the wooden version of the plane equipped with a 100 hp. Kinner engine weighing 280 lb. had an unloaded weight of 1500 lbs. The stainless model which is a four place job carries a 210 hp. Kinner and has an empty weight of 1773 lb. of which 140 lb. are accounted for in the extra weight of the larger engine.

Overseas Club Elects

NEW YORK, Nov. 12—At the regular monthly meeting of the Overseas Automotive Club held here today, George Tiffany, Overseas Motors Service Co., was elected president for the coming year. Other officers were elected as follows: C. M. Peter, export manager, Black & Decker Mfg. Co., first vice-president; R. C. Thompson, export manager, Prest-O-Lite Storage Battery Sales Corp., second vice-president; J. D. Helthall, manager of export sales, Sherwin-Williams Co., treasurer; George E. Quisenberry, editor of *El Automovil Americano* and the *American Automobile* (Overseas Edition), secretary; Jay S. Tuthill of the Business Publishers International Corp., assistant secretary and treasurer. Directors of the club, in addition to the above, include R. L. Bracken, W. D. Blood, Alfonso Grez, Peter Karl and Clement Pueschel.



Sales of General Motors for October, and Previous Months

	1931	1930	1929	1928
September	51,740	75,805	124,723	118,113
October	49,042	57,757	114,408	109,789
November	———	41,757	68,893	70,414
December	———	57,989	44,216	25,435
Total		1,057,710	1,498,792	1,492,461

Sales to Dealers in United States

	1931	1930	1929	1928
September	47,895	69,901	127,220	136,870
October	21,305	22,924	98,559	91,428
November	———	48,155	39,745	27,672
December	———	68,252	36,482	27,779
Total		1,035,660	1,535,852	1,462,556

Total Sales to Dealers in U. S. and Canada Plus Overseas Shipments

	1931	1930	1929	1928
September	58,122	78,792	146,483	167,460
October	25,975	28,253	122,104	120,876
November	———	57,257	60,977	47,587
December	———	80,008	40,222	35,441
Total		1,174,115	1,899,267	1,810,806

Unit sales of Chevrolet, Pontiac, Oldsmobile, Oakland, Buick, LaSalle and Cadillac passenger and commercial cars are included in the above figures.

Lawson Made Commissioner

Trade Commissioner E. B. Lawson, now in the United States on furlough from his post in Johannesburg, has been designated Automotive Trade Commissioner. Mr. Lawson will sail for South Africa in late January. The territory in which he will function as automotive trade commissioner will include the Union of South Africa, Rhodesia, Portuguese West Africa, Portuguese East Africa, Kenya, Uganda and Tanganyika. Mr. Lawson's knowledge of these regions well qualifies him to serve the American automotive industry there.

Canadian Plant Resumes

HAMILTON, ONT., Nov. 9 — Announcement was made today by E. W. BeSaw, general manager of the Firestone Tire & Rubber Co. of Canada, Ltd., this city, to the effect that manufacturing will be resumed at full capacity before the end of this week.

Plan Welding Conference

MINNEAPOLIS, Nov. 9—A welding conference will be held on the ground floor of one of the new buildings of the Caterpillar Tractor Co. at 2601 University Avenue, Nov. 19, 20 and 21, under the joint auspices of the Northwest chapter of the American Society for Steel Treating and the Manufacturers Association of Minneapolis. Floor space to the amount of about 15,000 sq. ft. will be available. All manufacturers of welding equipment have been invited to take part.

Waco Reports Loss

NEW YORK, Nov. 9—Waco Aircraft Co. reports net loss for the nine months ended Sept 30 of $54,023. This compares with a loss for the corresponding period of last year of $36,-918. Loss for the September quarter was $17,400, as compared with $18,694 for the coresponding period of last year.

Allis Backlog Increases

CHICAGO, Nov. 9—Unfilled orders of Allis-Chalmers Mfg. Co. as of Oct. 31 totaled $8,101,000, a slight increase over $7,915,000 recorded as of Sept. 30.

Olds Produces 2229

DETROIT, Nov. 9—Olds Motor Works has reported production of 2229 cars during October, compared with 2590 in September.

Budd Develops Machine

NEW YORK, Nov. 10—Budd Wheel Co. has developed a new machine for locating spokes in the wire wheels simultaneously.

G. M. Sales Hold Up

NEW YORK, Nov. 10—General Motors dealers throughout the United States sold 49,042 units to consumers during October, as compared with 57,757 for the corresponding month last year. Sales by General Motors divisions to dealers in the United States during the month were 21,305 units, as compared with 22,924 units a year ago. Total sales by General Motors divisions to dealers throughout the world were 25,975 as against 28,253 last year.

September Financing Off

WASHINGTON, Nov. 12—Wholesale financing of automobiles during the month of September reached a volume of $35,846,247, as compared to a volume of $43,947,450 during the previous month, and of $45,310,662 during the previous September, according to preliminary figures released by the Bureau of the Census, and based on returns for 402 companies engaged in the automobile financing business.

Retail financing volume was divided as follows:

Total All Units

	No. of Cars	Dollar Volume	Average per Car
Sept.	176,644	$68,331,755	$387
Aug.	205,022	79,640,977	388
Sept., 1930.	219,072	90,296,562	412

New Car Financing

	No. of Cars	Dollar Volume	Average per Car
Sept.	67,644	$38,652,005	$571
Aug.	83,613	48,870,687	561
Sept., 1930.	92,086	52,819,786	574

Pioneer Making "Wobblemeter"

NEW YORK, Nov. 12—The wobblemeter which was developed by Dr. F. A. Moss, head of the department of psychology of George Washington University, with the cooperation of the research committee on riding qualities of the Society of Automotive Engineers, the Bureau of Standards and the laboratories of several manufacturing companies, has gone through extensive laboratory trials and its use may be extended into the departments of aviation, psychology and psychiatry, says Charles H. Colvin, president of the Pioneer Instrument Co., which is now manufacturing the wobblemeter.

Detroit Production Men Visit Cincinnati Plant:

Fiat and Polish Company Agree

Plan Calls for Use of Italian Patents, Rights

WASHINGTON, Nov. 9—Conclusion of an agreement has been made between Panstwowe Zaklady Inzynierji (Polish State Engineering Works, which is under the control of the War Department) and the Fiat (Italian) company by which the former has acquired the exclusive right for the manufacture and sale in Poland of the complete Fiat line—comprising automotive vehicles, airplanes and motor boats, according to an Automotive Division announcement based on reports in the Polish press. The "P.Z.I." acquires all plans, charts, factory instructions, etc., applicable thereto so that actual production can begin in the near future, without any loss of time and expenditure of capital on the part of the "P.Z.I." in developing its own models. Fiat automobiles, it is announced, will be manufactured in the state-owned plants operated by the "P.Z.I." in Praga and/or Czechowice, both in the suburbs of Warsaw. The "P.Z.I." does not pay any definite sum for the licenses hereby obtained, but will give a certain royalty on the price of every vehicle manufactured. The "P.Z.I." also obtains from the Fiat Co. credits exceeding $1,000,000, with the promise of further sums as and when production develops. These will be in the form of open credits and used entirely in the interest of the development of the domestic industry.

The Fiat Co. will finance the retail sale in Poland of motor vehicles manufactured (or assembled) by the "P.Z.I." and will, moreover, provide the necessary capital for the establishment of a separate selling organization which will take over from the "P.Z.I." on a cash basis its entire production output under Fiat license. It is not proposed that any special types of cars will be manufactured under this agreement, the existing Fiat line being considered well adapted to road conditions in Poland. The announcement further points out that the Fiat Co. gains very specific advantages under this contract, and that Fiat models will undoubtedly become dominant in the Polish market.

Memphis Plants Open

MEMPHIS, Nov. 12—A considerable improvement in fall trade brings the announcement of the return to work of 1400 men at one body plant here, the Fisher Body Corp. in North Memphis, and the expected employment of several hundred men before the end of the year at the Murray Wood Products Co. plant in North Memphis. The latter plant is now operating on about the same schedule as followed during summer but increased receipt of orders indicates a large employment in the remaining lap of 1931. The old employees are being returned to work as rapidly as possible. The Fisher plant is now operating four days a week, day and night shift. It has been on this basis several weeks, but was closed down in September.

Casing Shipments Off

NEW YORK, Nov. 11—Tire casing shipments during September were 3,931,860, according to the Rubber Manufacturers' Association. This represents a decrease of 20.7 per cent under August, as compared with a normal seasonal decrease of 15.2 per cent. This is also a drop of 10.7 per cent under September of last year.

Production during the month is placed at 3,171,969 units, a drop of 18.8 per cent under August and 5.7 per cent under Sept., 1930.

Inventories as of Sept. 30 were 8,158,453, a decrease of 8.3 per cent under August, and 16.9 per cent below September of last year.

Chrysler Third in Dealerships

DETROIT, Nov. 10—Announcement has been made by Chrysler Sales Corp., that it now ranks third among the dealer organization of American motor car manufacturers. This announcement is based on the dealer listing maintained by the Chilton Class Journal Co., publishers of *Automotive Industries*.

Spanish Tariff Favors France

WASHINGTON, Nov. 12—Effective Nov. 10, a Franco-Spanish supplementary agreement grants to France reduced import duties in the Spanish tariff on automobiles, tires and tubes, motorcycles and accessories and velocipedes, etc., according to cablegrams from Commercial Attache Charles A. Livengood, Madrid, and Acting Commercial Attache Daniel J. Reagan, Paris. In return Spain is granted the minimum rates of the French tariff on a list of products of interest to Spain. The United States does not have a most-favored nation treaty with Spain and will continue to be assessed the maximum duties.

Petroleum Imports Down

NEW YORK, Nov. 11—Imports of petroleum at the principal ports of the United States for the week ended Nov. 7 have been estimated by the American Petroleum Institute at 228,857 barrels daily. This compares with the daily average of 298,000 barrels daily for the week ended Oct. 31.

Crude runs to stills during the week are placed at 2,294,000 barrels daily. Cracked gasoline produced during the week was placed at 3,445,000 barrels.

Stocks of gasoline at bulk terminals and in transit, east of California, for the week ended Nov. 7, totaled 12,966,000 gallons, as compared with 13,527,000 gallons for the previous week, and with 12,662,000 gallons for the week ended Nov. 8, 1930.

Young Wire Reports Profit

DETROIT, Nov. 10—L. A. Young Spring and Wire Corp., has reported net profit for the quarter ened Sept. 30, of $8,924, equal to 2 cents a share, compared with $220,884 or 53 cents a share in the corresponding period last year.

Net profit for the first nine months of 1931 was $618,133 against a net profit of $1,301,538 for the first nine months of 1930.

Develops New Bar Guard

NEW YORK, Nov. 9—Nil Melior, Inc., has developed a new bar-type radiator guard for the "V"-front late-model Packards.

On Sunday, Oct. 25, about 370 members of the evening executive courses in engineering of the University of Detroit, accompanied by officials of the various plants in which they work, visited the plant of the Cincinnati Milling Machine Co. In the evening the party was entertained at a dinner in the dining room of the company, and listened to an address of welcome by Fred A. Geier, president. Among the plants represented at the meeting by members of the group were Timken Detroit Axle, Ternstedt, Packard, Chevrolet and Ford

Detroit Plants Get Under Way

Body Makers Taking Large Share of New Development Lists

DETROIT, Nov. 11—While production of complete cars is still lagging behind last year, automotive plants are again reaching reasonably high production schedules with concentration on parts production ahead of final assembly. Employment in the Detroit area is steadily climbing, and the last week or so in November and December should find a number of automobile plants on a near-capacity schedule to furnish dealers with samples of new cars to be introduced at the New York show.

The major hold-up in production this year will probably be at the plants of body manufacturers who are bearing the brunt of important changes being made in automobiles generally for 1932. Die cost for the industry has been unusually high this year due to the large number and the type of body changes being made.

Both Ford and Chevrolet are gradually stepping up operations, and it is expected that Chevrolet at least will be in good production of completed automobiles within a week. A considerable bank of finished parts is being built up by both companies in anticipation of final assembly and in order to avoid production and employment peaks coincident with introduction of new or revised models.

Kelsey-Hayes is Confident

DETROIT, Nov. 9—Perry Williams, general sales manager of the Kelsey-Hayes Wheel Corp., reports that his company is looking ahead with a considerable degree of assurance and increased confidence for improved business within the automotive manufacturing industry.

"Today we have more accounts than ever before with whom we are doing business and these comprise the very largest companies in the industry," Mr. Williams said.

"Daily specifications for delivery are being released to us by these manufacturers and our present production volume on the new and present models is highly satisfactory."

Aero Show Plans Progress

DETROIT, Nov. 9—Preliminary arrangements for the National Aircraft Show of 1932, to be held at Detroit City Airport, April 2 to 10, will formally get under way here tomorrow with the initial meeting of the exposition's Board of Control, a group of five men selected by the Aircraft Bureau, Detroit Board of Commerce, and the Aeronautical Chamber of Commerce of America, Inc.

William B. Mayo, chief engineer, Ford Motor Co., and Edward G. Macauley, manager of the aviation division, Packard Motor Car Co., are members of the board representing the Aircraft Bureau. Indications are that the Aeronautical Chamber, which organization is sponsoring the event, will be represented by George S. Wheat, vice-president, United Aircraft & Transport Corp.; Charles S. (Casey) Jones, vice-president, Curtiss-Wright Corp., and Luther K. Bell, general manager of the Chamber. Wheat is a member of the Executive Committee of the Chamber. Jones is a member of the organization's show committee. Although he serves on the Chamber's show committee, Mayo also is president of the Aircraft Bureau.

The show, which is being held here for the second successive year, will be managed by Ray Cooper, manager of the Detroit organization's Aircraft Bureau.

Murray Reports Loss

DETROIT, Nov. 9—Murray Corp. of America has reported for nine months ended Sept. 30 net loss of $505,153 after depreciation, etc., compared with a net profit of $750,258 for the same period last year.

In his statement to stockholders C. W. Avery, president, says, "The industry in general, and our business in particular, have been at a very low ebb during the third quarter. Present information indicates a revival of our business early in 1932.

"We are increasing the capacity of our frame and heavy stamping plant at Ecorse, Mich., 200 per cent, based upon new business that we have for next year."

Foreign Cars in Salon

NEW YORK, Nov. 9—Among the exhibitors at the annual Automobile Salon which will open at Hotel Commodore Nov. 29 will be a number of foreign cars, including the English Rolls-Royce, the French Delage, the Belgian Minerva, the German Maybach, and the Italian Lancia, with one or two possible additions.

American cars to be shown will include Cadillac, Chrysler Imperial, Duesenberg, Franklin, Lincoln, Marmon, Pierce-Arrow and Stutz.

Wins N.A.C.C. Prize

NEW YORK, Nov. 9—Melvin Densmore of Eldred, Pa., is the winner of the first prize of the highway safety essay contest put on by the National Grange and the National Automobile Chamber of Commerce. As such, he will attend the sessions of the grange at Madison, Wis., as a guest of the National Automobile Chamber of Commerce. Five other members from as many states will receive cash prizes.

Quick Reading

The United States Department of Agriculture has published Technical Bulletin No. 372, "The Marketing and Distribution of Fruits and Vegetables by Motor Trucks." Authors of the bulletin are Brice Edwards, assistant market specialist, and J. W. Park, agricultural economist, Bureau of Agricultural Economics. The bulletin may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 20 cents.

The Government of Austria has established a testing institute under the direction of the Technical University for examining of airplanes and equipment purchased abroad. If the airplanes are approved they are licensed by the Ministry of Commerce.

Members of the Massachusetts Automobile Operators Association have gone on record as opposing any extension of their sales tax to automobiles. An interesting sidelight is a pledge signed by the members binding them to return to their congressmen for payment any bills which might be incurred by them as a result of any sales tax which might be passed.

Moltrup Steel Products Co., Beaver Falls, Pa., has announced the opening of a Detroit office under the management of H. F. Hawthorne, who was formerly with the Firestone Rubber Co.

Juan de la Cierva, inventor of the autogiro, is expected to arrive in the United States some time during the month of November. Two flying-boat-type autogiros are being completed for the French navy, the Autogiro Co. of America reports.

The motorcycle is well adapted to Mexico, according to Edward B. McLaughlin, assistant trade commissioner, in a report to the Automotive Division, Bureau of Foreign and Domestic Commerce. Its chief and almost only utility, however, is in commerce. The federal and state government, together with the larger municipalities, form the largest buying group for motorcycles of superior quality.

Latvian trade in motorcycles is practically at a standstill, according to Assistant Trade Commissioner Everett C. Ansley in a report to the Automotive Division, Bureau of Foreign and Domestic Commerce. Prospective buyers are unable to pay cash and dealers are experiencing difficulty securing financing from either local or foreign sources.

Automobile prices in the Argentine are increasing, while imports and sales decline, according to the Automotive Division, Bureau of Foreign and Domestic Commerce.

Swift of Coventry, British cycle and motor car manufacturer, is in process of liquidation following heavy losses sustained in 1920-26, according to a report to the Automotive Division, Bureau of Foreign and Domestic Commerce.

The Rover (British) Co. has announced that it will build in Wellington the bodies of all its cars used in New Zealand, according to a report to the Automotive Division, Bureau of Foreign and Domestic Commerce.

Beginning with January, 1932, the number of separate items included in the export report on automotive products will be considerably expanded, according to an announcement from the Automotive Division, Bureau of Foreign and Domestic Commerce.

The International B. F. Goodrich Corp. has announced the appointment of Robert Tefel as representative in the West Indies for Goodrich and its subsidiaries.

Cummins Engine Co., Columbus, Ind., plans to have one of its new Diesel automotive engines designed for truck and bus use on the test block about Nov. 20. When the block and field test programs have been completed, the engine will be available to all truck and bus manufacturers.

Foote Bros. Gear & Machine Co., Chicago, has announced the opening of a new district office in Milwaukee in charge of L. W. Erickson.

Martin-Parry Reports Loss

NEW YORK, Nov. 10—Martin-Parry Corp. reports net loss for the year ended Aug. 31 of $332,382. This compares with loss for the preceding year of $423,802.

Percentage of Aircraft Accidents Attributable to Powerplant Failures, by Types of Failure
(First Six Months of 1931)

	Percentage				
Fuel system	3.59	3.85	5.15	4.01	4.20
Cooling system	1.52	.48	.21	.91	.84
Ignition system	.69	0	1.62	2.42	1.79
Lubrication system	0	0	.21	1.07	.62
Engine structure	4.01	0	3.19	3.15	3.15
Propeller and accessories	0	1.92	1.28	.38	.60
Engine control system	.14	0	0	.29	.18
Miscellaneous	3.73	1.44	2.23	3.58	3.18
Undetermined	2.85	5.96	4.64	5.47	4.81
Total powerplant failures	16.53	13.65	18.53	21.28	19.37

October Production Estimated at 86,328

NEW YORK, Nov. 9—American production of cars and trucks during October totaled 86,328 units, according to preliminary estimates prepared by the National Automobile Chamber of Commerce. These figures are based on reports of factory shipment of new cars. This represents a decline of 40 per cent from the preceding month, and a drop of 46 per cent from the production of October last year.

The industry's production for the first 10 months of the year is estimated at 2,283,018 units, a drop of 29 per cent under that for the first 10 months of last year.

Reo Reports Loss

DETROIT, Nov. 9—Reo Motor Car Co. has reported for quarter ended Sept. 30, net loss of $771,345 compared with a net loss of $151,451 in the second quarter and with net loss of $956,488 in the same period last year.

Net loss for nine months ended Sept. 30 is $1,343,628 against net loss for the first nine months last year of $1,305,886.

Foote Merger Off

CHICAGO, Nov. 9—Foote Brothers Gear and Machine Co. has advised the New York Curb Exchange that the committee appointed to receive stock deposits for the purpose of merging with Dodge Mfg. Corp. has voted to abandon the plan, deciding the merger was not in the interest of Foote stockholders.

Diamond T Sales Increase

CHICAGO, Nov. 9—October sales of Diamond T Motor Car Co. were 90 per cent over the 1930 month and marked the fifth consecutive month to show an increase, according to E. J. Bush, vice-president. Last month's sales brought figures for 1931 to date to within 4 per cent of last year.

Battery Makers Elect

NEW YORK, Nov. 9—National Battery Manufacturers' Association at its seventh annual convention held last month elected R. D. Mowry, general manager of the Universal Battery Co., as its president for the coming year.

Other officers are: First vice-president, C. O. Wanvig, Globe Union Mfg. Co.; second vice-president, L. N. Talkes, president of the Cleveland Storage Battery Co.; secretary, L. A. Doughty, president of Carlile & Doughty, Inc.; treasurer, E. Handler of Lyons Storage Battery Co., and commissioner, W. J. Parker.

Directors for the ensuing year are A. A. MacLean, vice-president of USL Battery Corp.; L. Perrine of Perrine Quality Products Corp.; O. L. Schutz, Grant Storage Battery Co., and E. D. Martin, vice-president of the Emark Battery Corp. A standards committee consisting of H. D. Stanley, Emark Battery Corp., as chairman, and A. R. Reid, USL Battery Corp.; O. W. A. Oetting, Globe Union Mfg. Co.; E. Handler and O. L. Schutz was appointed.

The association went on record as being opposed to the practice of rebuilding worn-out batteries for resale where the container or any part bears the trade mark of the original manufacturer. The next meeting will be held in Chicago in May, 1932.

J. B. Eccleston

DETROIT, Nov. 9—J. B. Eccleston, 63 years old, the first general sales manager of Oakland Motor Car Co., died in Pontiac General Hospital, Wednesday, after a two days' illness.

Mr. Eccleston was sales manager for the Stearns Bicycle Co. until 1900 and then was president of the Centaur Automobile Co. He joined Oakland in 1903 and was in charge of the sales department until 1913, when he retired from active business.

Buick Sponsors Contest

DETROIT, Nov. 9—Buick Motor Co. has announced a $50,000 prize contest in connection with the presentation on Nov. 14 of its new 1932 models. The contest will begin the day the new car appears, Nov. 14, and continue until midnight Dec. 14.

The prizes are to be awarded for the best answers to the question: Why does the new Buick eight, at new low prices, again confirm the Buick pledge, "When better automobiles are built, Buick will build them?"

Automotive Steel Demand Sustained

Parts Makers Planning Additional Business in Moderate Tonnage

NEW YORK, Nov. 12—The drop of 25,401 tons revealed by the leading steel producer's unfilled tonnage statement, as of Oct. 31, which was made public on Tuesday, was interpreted in the steel market as indicating a steadying of the rate at which steel is being bought. They very slight decline in the backlog was thought to be due rather to a mild stepping up of operations than to any further dwindling of commitments. Since the beginning of November the rate of ingot production has made further gains, operations of primary producers being approximately 7½ per cent higher than during the second half of October.

Automotive demand is well sustained. Parts makers have been placing additional business for moderate tonnages of sheets and strip steel. A good deal of sheet business from body plants going into better production overhangs the market. Demand for cold-finished steel bars has also improved. Chicago and Cleveland sellers report more buying activity than those in western Pennsylvania. One of the Mahoning Valley sheet rolling mills has resumed operations on a 75 per cent basis following a week's shutdown. Demand generally has broadened somewhat this week and industries that heretofore were altogether out of the market have begun to place small orders. This makes for a decidedly better feeling. In sheets and strip steel automotive buying, however, continues to be the outstanding feature.

Gains in orders are by no means spectacular, but the very fact that there are gains is the cause of much more confidence than has been in evidence in some time. Prices are unchanged all along the line.

Pig Iron—There has been more small-lot buying by automotive foundries this week than in several months. Competition between Valley and Lake furnaces continues keen. Quotably the market is unchanged.

Aluminum—Quiet and routine in character.

Copper—A virtual deadlock is reported to have occurred in the negotiations between the American and foreign copper producers which have been in progress for the past few weeks with a view toward curtailing output. The American producers are holding out for a 50 per cent cut in the current rate of production. The Belgian owners of the famous Katanga mines in South Africa consider the extent of curtailment less important than the share of the market to which they believe themselves entitled. They claim to have a capacity of 500,000,000 lb. a year, and that any cut in production should be on that basis. Their claim is opposed by those who say they have never operated at a higher rate than 400,000,000 lb. a year, and this for only a short time. The market is firm at seven cents, Valley.

Tin—The rise in the price of silver has caused the tin market to turn firm, prompt Straits tin selling at 23½ cents at the beginning of the week.

Status of Aircraft, Gliders, Pilots, Glider Pilots and Mechanics by States as of October 1, 1931

State	Aircraft				Pilots						
	Licensed	Unlicensed	Total	Gliders	Transport	Limited commercial	Industrial	Private	Total	Glider pilots	Mechanics
Alabama	33	31	64	2	38	3	0	60	101	1	53
Arizona	42	11	53	3	26	9	0	67	102	0	41
Arkansas	53	15	68	0	42	8	1	91	142	0	61
California	957	218	1,175	261	1,131	204	20	1,865	3,220	114	1,664
Colorado	49	36	85	92	58	21	0	60	139	0	80
Connecticut	112	28	140	12	64	24	0	98	186	0	135
Delaware	58	10	68	3	12	3	0	16	31	0	20
Dist. of Columbia	83	6	89	12	191	6	0	64	261	0	148
Florida	120	65	185	8	147	28	1	157	333	1	286
Georgia	44	47	91	1	48	7	0	33	88	0	48
Idaho	23	12	35	6	28	6	0	23	57	0	24
Illinois	505	239	744	77	427	114	4	576	1,121	18	559
Indiana	171	113	284	33	118	42	1	185	346	9	145
Iowa	138	60	198	22	103	44	0	164	311	4	141
Kansas	161	154	315	53	112	23	0	104	239	2	193
Kentucky	38	20	58	2	44	11	0	39	94	1	46
Louisiana	87	20	107	2	49	12	2	38	101	0	67
Maine	36	20	56	1	30	7	0	31	68	0	25
Maryland	86	23	109	2	57	23	0	79	159	1	114
Massachusetts	211	42	253	22	161	55	0	288	504	3	209
Michigan	381	155	536	122	313	90	1	472	876	20	451
Minnesota	124	89	213	25	125	37	0	112	274	2	133
Mississippi	29	11	40	1	19	8	1	38	66	0	20
Missouri	231	125	356	12	260	49	3	159	471	2	274
Montana	36	31	67	1	33	13	0	42	88	1	55
Nebraska	161	58	219	9	98	27	0	140	265	1	121
Nevada	14	5	19	2	5	13	1	13	32	0	22
New Hampshire	26	6	32	5	11	15	0	25	51	5	23
New Jersey	210	119	329	41	176	42	1	272	491	7	303
New Mexico	25	5	30	1	20	5	0	33	58	0	18
New York	927	273	1,200	127	587	199	6	1,019	1,811	45	880
North Carolina	67	42	109	5	32	17	0	50	99	2	49
North Dakota	42	36	78	3	29	8	0	33	70	0	30
Ohio	441	192	633	107	393	118	0	430	941	16	512
Oklahoma	259	104	363	14	199	38	3	193	433	0	158
Oregon	79	69	148	14	64	18	0	123	205	1	107
Pennsylvania	467	91	558	53	185	139	3	558	885	9	403
Rhode Island	31	8	39	3	15	5	0	53	73	2	24
South Carolina	20	30	50	2	18	3	0	23	44	0	22
South Dakota	58	18	76	14	39	11	0	53	103	0	50
Tennessee	66	33	99	7	52	12	0	89	153	3	74
Texas	329	123	452	20	462	48	3	298	811	2	403
Utah	32	8	40	8	42	7	0	14	63	0	66
Vermont	18	3	21	1	11	8	0	13	32	1	14
Virginia	58	17	75	6	146	11	1	60	218	0	271
Washington	130	64	194	19	144	53	1	158	356	0	188
West Virginia	48	15	63	4	23	8	0	40	71	1	29
Wisconsin	183	100	283	28	120	44	0	149	313	3	103
Wyoming	55	12	67	3	22	5	0	19	46	0	67
Alaska	20	5	25	0	22	2	1	2	27	0	17
Canada[1]	0	0	0	0	9	0	0	5	14	0	10
Canal Zone	0	1	1	1	49	3	0	4	56	9	70
Hawaii	7	1	8	0	58	2	0	11	71	0	100
Mexico[1]	0	0	0	0	12	0	0	4	16	1	7
Philippine Islands	3	1	4	0	10	0	0	1	11	0	5
Foreign miscellaneous[1]	4	1	5	0	33	1	0	11	45	0	28
Total	7,588	3,021	10,609	[2]1,272	6,722	1,709	54	8,757	[3]17,242	[4]296	[5]9,166
Percentages	....	....	.....	.....	38.9	10	.3	50.8	100	....	.....

[1] Figures for these countries mean pilots licensed by the United States who live in foreign countries.
[2] This figure includes 111 licensed gliders and 1161 unlicensed gliders.
[3] This figure includes 476 women pilots—35 transport, 54 limited commercial, 1 industrial and 386 private.
[4] This figure includes 8 women glider pilots.
[5] This figure includes 5 women mechanics.

Adopts New Carburetion

The Stutz Motor Car Co. has adopted what it refers to as hydro-thermic carburetion for its DV-32 models. Instead of the inlet manifold being heated by exhaust gases, it is heated by water leaving the cylinder jackets. The same intake manifold is used as previously, when exhaust gases were carried through a jacket around it above the carburetor. However, the heater pipes which carried the exhaust gases across the top of the engine and back have been eliminated. Hot water from the front end of the water outlet pipe leading to the radiator is taken through a copper tube to the top of the intake manifold heater. From the bottom of the manifold heater a ½-in. copper tube carries the water to the inlet of the circulating pump. Aside from eliminating the double heat transfer pipes extending across the top of the engine, the new arrangement is said to have the advantages that it keeps the temperature of the charge entering the cylinder more nearly constant and that it lowers the operating temperature of the engine.

+ + CALENDAR + + OF COMING EVENTS

SHOWS

Olympia Truck Show, London..Nov. 5-14
Passenger Car Show, Glasgow..Nov. 13-21
Salon, New York City.....Nov. 29-Dec. 5
Motorcycle Show, London..Nov. 30-Dec. 5
National Automobile, New York..Jan. 9-16
San Francisco, Automobile.....Jan. 9-16
Newark, N. J., Automobile.....Jan. 16-23
Cincinnati, Automobile .....Jan. 17-23
Milwaukee, Wis., Automobile...Jan. 17-23
Philadelphia, Automobile .....Jan. 18-23
Louisville, Ky., Automobile....Jan. 18-23
Omaha, Neb., Automobile.....Jan. 18-23
Boston, Mass., Automobile.....Jan. 23-30
Minneapolis, Minn., Automobile.Jan. 23-30
Hartford, Conn., Automobile...Jan. 23-30
Detroit, Automobile .....Jan. 23-30
Montreal, Automobile .....Jan. 23-30
Baltimore, Automobile .....Jan. 23-30
Pittsburgh, Pa., Automobile...Jan. 23-30
St. Petersburg, Fla., Automobile, Jan. 27-29
National Automobile, Chicago, Jan. 30-Feb. 6
Salon, Chicago .....Jan. 30-Feb. 6
Washington, D. C., Automobile Jan. 30-Feb. 6
Cleveland, Automobile ....Jan. 30-Feb. 6
Springfield, Ill., Automobile.....Feb. 4-6
St. Paul, Automobile.....Feb.6-13
St. Louis, Automobile .....Feb. 7-12
Denver, Colo., Automobile.....Feb. 8-13
Peoria, Ill., Automobile.....Feb. 9-14
Salon, Los Angeles, Calif.....Feb. 13-20
Kansas City, Automobile.....Feb. 13-20
Mankato, Minn., Automobile...Feb. 17-20
Holyoke, Mass., Automobile...Feb. 18-22
Des Moines, Iowa, Automobile..Feb. 21-26
Wichita, Kans., Tractor and Power Equipment .....Feb. 23-26
Salon, San Francisco, Calif..Feb. 27-Mar. 5

CONVENTIONS

National Association of Finance Companies, Chicago.....Nov. 17-18
American Society Mechanical Engineers—Annual meeting, New York City .....Nov. 30-Dec. 4
American Roadbuilders Association, Detroit, Mich. .....Jan. 11-14, 1932
S.A.E. Annual Dinner, New York City, Jan. 14
S.A.E. Annual Meeting, Detroit, Mich., Jan. 25-29

S.A.E. SECTION MEETINGS

Indiana (Indianapolis) .....Nov. 17
Metropolitan (New York City)...Nov. 19
Detroit (Student Activity) .....Nov. 24

Hercules Reports Profit

NEW YORK, Nov. 10—Hercules Motor Corp. reports net profit for the nine months ended Sept. 30 of $273,183. This is equivalent to 87 cents a share on outstanding stock and compares with earnings of $543,000 or $1.74 a share for the corresponding period last year.

Earnings for the September quarter were $39,811 or 13 cents a share, as compared with $177 or approximately 1 cent a share for the corresponding quarter last year. Regular dividend of 20 cents a share was declared payable Jan. 1 to stockholders of record Dec. 18.

How Pierce-Arrow made sure the Motoring Public gets what it wants

Most motorists now prefer steel wheels. Some motorists still prefer artillery wheels. Pierce-Arrow, aware of both these facts, made the new Budd-Michelin Steel Artillery Wheel special equipment on current Pierce-Arrow models.

On these models, the beauty of this new Budd-Michelin Wheel shows to good advantage. But beauty is not its only virtue. It is six pounds lighter than an equivalent wood wheel. In lateral tests, it proves to be four to five times stronger. And it permits better decoration at less cost.

In low-carbon steel, this wheel can be given a natural wood finish—or can be finished with lacquer the same as the body. This makes finishing a matter of hours instead of days.

In stainless steel (the material used in the Pierce-Arrow Wheel), it harmonizes with any color scheme, and enhances the brilliance and richness of any car.

This new Budd Wheel is on display in the Budd plants in Philadelphia and Detroit. We'd like to show it to you and to tell you more about it.

BUDD WHEEL COMPANY
MAKERS OF BUDD-MICHELIN WHEELS
Detroit Philadelphia

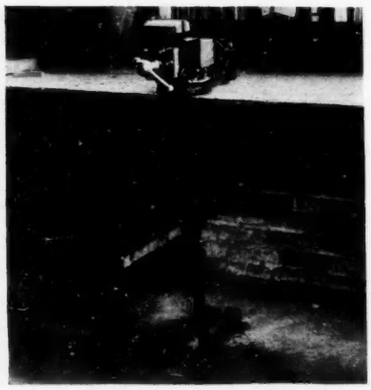
★WHEELS BY BUDD★

NEW DEVELOPMENTS
Automotive Parts, Accessories and Production Tools

Toggle Attachment for Operating Bench Vise

A toggle-operating attachment for bench vises has been added by the Tomkins-Johnson Co., Jackson, Mich.

In this attachment as in the air cylinder attachment, described in *Automotive Industries*, the simplicity of installation is outstanding. No change is necessary on the vise except the removal of the nut. The vise is mounted on a steel casting which is secured



through the bench to a plate underneath, which supports the toggle-operating mechanism. This attachment also can be adapted to any standard bench vise, retaining the original stroke and fine screw adjustment on the vise, and is especially advantageous where an air cylinder operating attachment would not be convenient.

All-Steel Squaring and Slitting Shear

A new line of all-steel squaring shears with hydraulic holddowns is announced by the Cincinnati Shaper Co., Cincinnati, Ohio. Unusually high speeds are claimed for these steel squaring shears; for example, the 3/16 in., 10-ft. and 12-ft. shears operate at 60 strokes per minute. The ½-in., 10-ft. and 12-ft. shears operate at 40 strokes per minute.

In combination with the speed an exceptional degree of accuracy is offered. Accuracy is said to be due to several factors, the most important of which are the hydraulic holddowns, the low rack, and the rigidity of the all-steel construction. The hydraulic holddowns deliver great clamping pressures to prevent sheet slippage. They also deliver a uniform pressure regardless of variations in the thickness of the sheets. The low rack or shear angle (5/16 in. per foot on the ⅜ in., 12-ft. shear) greatly reduces distortion in the work.

A deep steel plate is used for the upper knife bar. A hardened and ground guide bearing for the knife bar is mounted on the housings. The knife bar slides, bronze lined, bear around this guide. The backward thrust on the knife bar during a cut is taken against this wide flat bearing.

A deep horizontal steel brace is fastened to the back of the upper knife bar. This wide brace prevents the knives springing apart (side thrust) during the cut. Adjustment is provided between this brace and the upper knife bar at 12-in. intervals so that exact alignment of the knives can be easily maintained.

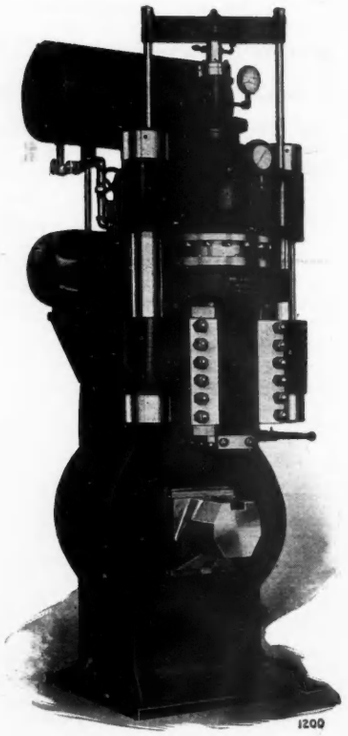
The drive is vee belt motor to the flywheel, then through a silent worm and wheel reduction unit to the main shaft. The worm is hardened and ground and mounted on anti-friction bearings. The worm wheel has a rim of high tensile strength worm gear bronze mounted on a steel disk. Five clutch jaws are cut in this disk and hardened.

Hydromatic Press Unit

The French Oil Mill Machinery Co., Piqua, Ohio, has developed the Hydromatic, a high-speed, self-contained, hydraulic press unit. The illustration shows a 300-ton Horning press built for the Firestone Steel Products Co.

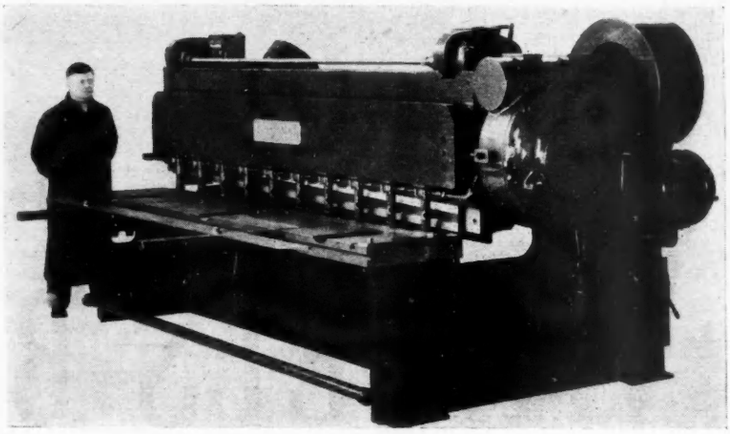
These presses are also made in the usual column types, and also with the columns inclosed in large housings for gib guiding the moving platen—the same construction as is followed on large crank presses. Hydraulic die cushions for drawing may also be built into the presses. These presses are made in sizes and capacities to suit any demand.

With these Hydromatic units, operation is by foot pedal or hand lever, and the hand lever also acts as an



emergency release at any part of the cycle by motion of the lever upward. The unit can be set to operate at any desired stroke or pressure, and when this pressure is reached the press may be set to instantaneously reverse to open position; or it can be set to hold the desired pressure for any desired period of time and then automatically return to the open position. The opening of the press is easily adjustable by means of the setting of a collar on a control rod.

(Turn to page 784, please)



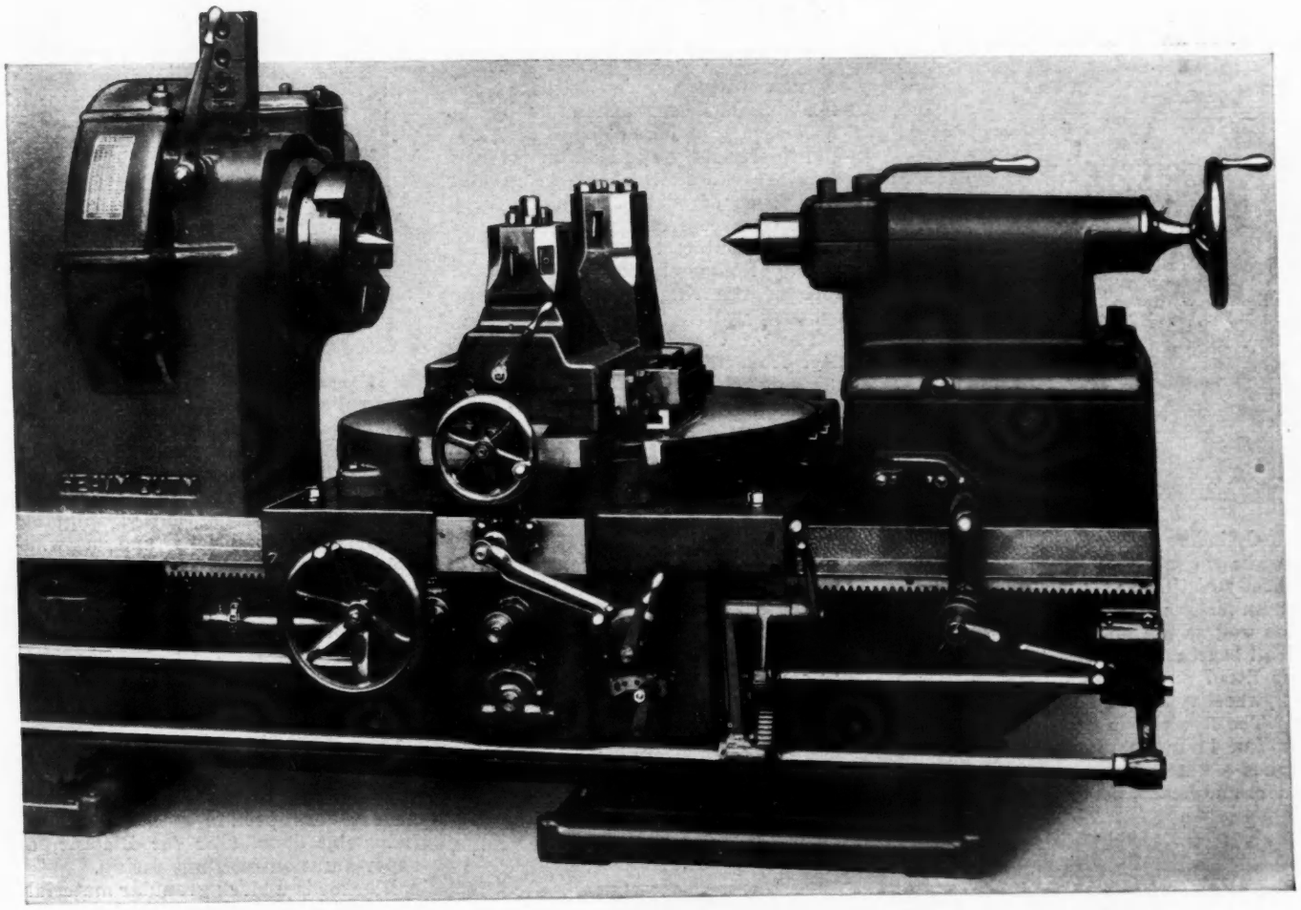
standard design with special features for

HIGH-SPEED SPHERICAL TURNING

A standard engine lathe with a few special features, and you have a high production machine on a difficult turning job.

The machine shown here is set up for rough and finish turning large spherical bearings which have an intermittent cut and require a very smooth finish.

It is designed for precision work at a maximum rate, and features rigidity, centralized control, easy set-up, and a wide range of spherical work where accuracy and high production are desirable.



With this equipment the changing time from rough to finish cut is reduced because it is necessary only to index the front tool block.

Every problem is different. What's yours? You'll find it profitable to consult LeBlond engineers.

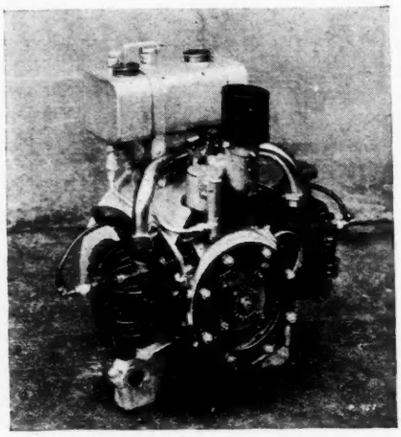
THE R. K. LeBLOND MACHINE TOOL CO.
Cincinnati, Ohio

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

Reed-Prentice Industrial Engine

Reed-Prentice Corp., Worcester, Mass., has placed on the market a small, two-cylinder, air-cooled engine for industrial purposes. While designed primarily for use with the Wolf portable timber-sawing machine, this engine is suitable for general use in the industrial field. The bore is 2½ in. and the stroke 2⅛ in., and the engine is rated to develop 8 hp. at 3600 r.p.m. The intake valve has a port diameter of 1 3/16 and the exhaust valve a port diameter of 1 1/64 in.



Cylinders are cast of nickel iron, while the cylinder heads are made of heat-resisting aluminum alloy. Aluminum pistons are used. The crankshaft as well as the camshaft is mounted in ball bearings. A Tillotson carburetor is fitted and ignition is by a Bosch flywheel type magneto.

The flywheel is cast in the form of a fan 11 in. in diameter, which supplies a blast of air against the cylinders and heads, being provided with a housing of magnesium alloy. The crankshaft and the connecting rods are drop-forgings that are machined all over. Connecting rod bearings are of the roller type. Crankcase and other general castings are of magnesium alloy, which explains the light weight of the engine—46 lb.

Lubrication is from an oil tank to one, and by splash to the opposite cylinder. The engine is started by means of a cord, as is customary with outboard motors.

Wide-Channel Ventilated Piston Ring

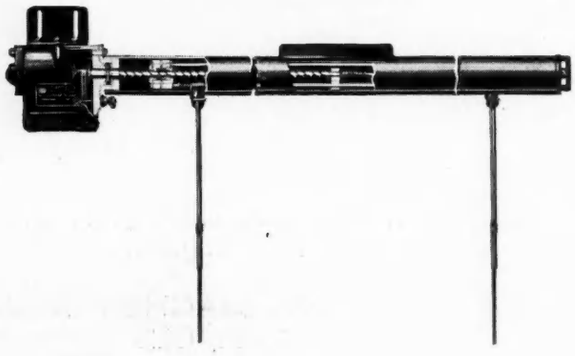
A new wide-channel, ventilated piston ring has been announced by the American Hammered Piston Ring Co., Baltimore, Md. The slots in the new ring are wider, which allows greater circulation of oil and is said to keep the ring free from carbon. Greater cylinder contact surface is provided, and approximately 50 per cent of the face of the ring bears against the cylinder wall.

The oil channel is interrupted 90 deg. from the gap, on each side of the ring, the objects being to assure proper lubrication of the entire circumference of the cylinder and to prevent oil chasing. In a wide-channel ring high unit pressure is essential, and the eight ventilating slots are said to be accurately proportioned so as to divide the ring exactly and produce uniform pressure.

Constant-Speed Windshield Wiper

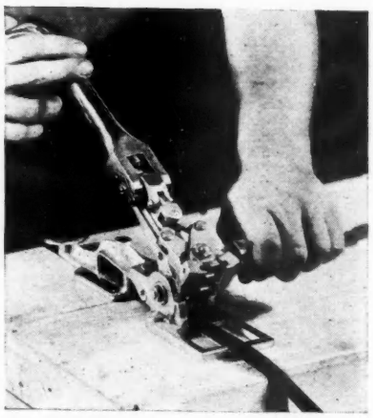
A full-vision type electric windshield wiper for passenger car use, which operates at a substantially constant speed regardless of the load on the engine, has been announced by the Handy Governor Corp. of Detroit. The new wiper is a direct development of the heavy-duty Handy which is already in use on trucks and buses.

The power of the electric motor is said to be sufficient to enable the wiper to cope successfully with heavy snow, and the additional battery drain is said to be less than that caused by a spotlight, and is, of course, limited to periods when the wiper is in use.



Signode Box Strapping Machine

A new machine for the shipping room which greatly simplifies and speeds up the strapping of all types of shipping containers has been developed by the Signode Steel Strapping Co., Chicago, Ill. This tool, the Signode strapping machine, both tightens and seals the steel strapping used to reinforce shipments.



It tightens easily and quickly with several short strokes of the tensioning handle. The colored trade-marked seal is snapped on and the sealing handle is pressed forward sharply to lock and seal the strap.

Many tests under varied shipping department conditions and a wide range of applications are said to indicate a saving of 25 to 30 per cent in time over the old method.

Lincoln Electric Co. to Distribute Blackor

The Lincoln Electric Co., Cleveland, Ohio, manufacturers of "Stable-Arc" welding equipment and "Linc-Weld" motors, has been appointed general industrial distributor for Blackor, a super-abrasion-resistant facing.

Blackor is a black granular material of high-grade tungsten-carbide. Its application to tools subject to abrasive wear does away with the use of insert metals as Blackor does the work of both inserts and hard-facing materials.

Applied with a carbon arc Blackor covers the entire abrasion surface of a tool or wearing element rather than just intermittent areas. It has the tensile strength of steel and in comparative tests shows the greatest resistance to abrasion of any material.